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Machine for Testing the Strength of Metals, Wire, Rope, Chain, Cast Iron Columns, Bridge Bolts, and Boiler Plates.

The present age is one in which only accurate knowledge can insure advancement. Experimental methods, having proved their superiority in the attainment of accurate knowledge, are constantly growing in favor. No matter to what extent mathematical theories may be applied to the computation of the strength of building materials, there are so many varying conditions which cannot be formulated that only actual test can determine the strains to which such materials can be safely subjected. There have been numerous testing machines constructed, but many have been cumbersome, and some so inaccurate as to prevent that refinement which should characterize every scientific experiment. We recently illustrated and described a refined arrangement calculated to insure the desired delicacy in this kind of tests, and we herewith give an engraving of still another, which, having been for several years in use, and having, we are told, been subjected to frequent comparison with what is known as the "Government machine," as well as those manufactured by other parties, has given entire satisfaction.

It is claimed for this machine that it possessess great strength, combined with much simplicity and accuracy, and that it can be furnished at less cost than other machines of corresponding capacity.

Its construction will be readily understood on reference to the accompanying engravings, the largest of which represents a machine of 100,000 lbs. capacity.

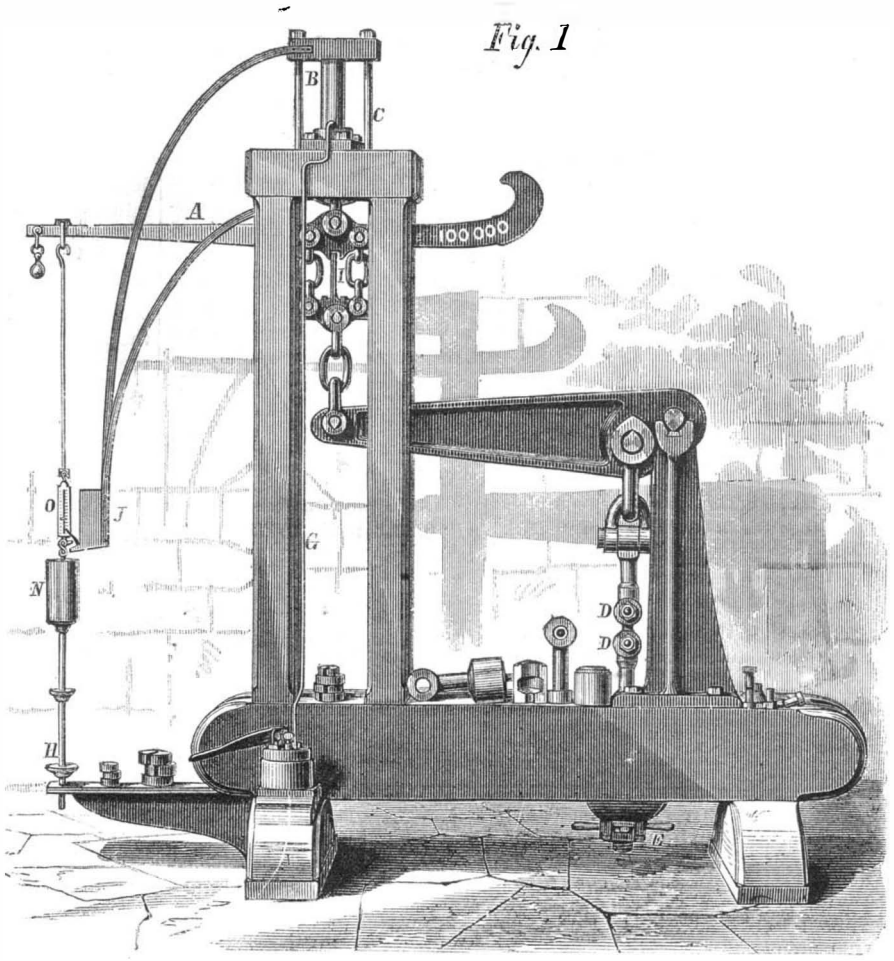
The crane beam, A, Fig. 1, is suspended from the hydraulic jack, B, by a yoke, C, and connected with this small end of the main lever by a clevis and fulcrum. The piece for testing is placed in the clutches at D D. All the bearing parts of the machine rest upon steel knife edges, and when ready for operating, the whole machine is in perfect equipoise, and so nicely adjusted that a half ounce weight placed upon the weight dish will, it is stated, turn the beam. Before the strain is applied, the slack is taken up by means of a screw and a nut at E; the beam is then raised by the jack and pump. The pump, is connected by the tube, G G, to the jack, and as the strain is applied, the beam is kept in equilibrium by placing weights on the dish, at H. The indicating finger, I, vibrates freely in the slotted place in the crane beam. Now, as the crane beam is placed between the small end of the main lever and the pulling jack, the strain is actually weighed by the beam, and not indicated by pressure in the hydraulic jack, as in some machines. In order to obtain a very accurate result, an ingenious self-feeding arrangement is applied, consisting of a reservoir, J (more clearly shown in Fig. 2), containing mustard seed shot, which is suspended from the jack, B, Fig. 1. A valve, M, Fig. 2, at the base of the reservoir, is opened by a pin attached to the beam rod, when the beam raises, which allows the shot to flow into the cup, N, on the beam rod. This cup, N, is suspended to a spring balance, O, which is secured to the rod. When the test piece breaks, the beam falls, and the small valve, M, closes, stopping the flow of the shot. The weight of the shot poured into the cup, N, is seen on the dial, which is marked in such a manner as to indicate twenty-five pounds (or even less, to ten or fifteen pounds, if necessary).

This machine, without the last improvement, is in successful operation in a number of places, and gives, as above stated, the most unqualified satisfaction.

The two figures, marked D, Fig. 1, represent a grip or vise, that holds the steel in a particularly firm manner, causing a fair and square break, and a correct test. In each end of the test pieces is bored a one and three eighths inch hole, and the piece is placed in the clutches with the thimble lightened up by the bolt which passes through, having a head and nut pressing on each side, so as to prevent bending of any kind. This system of combining a crane beam, with levers, hydraulic jack, or screw, can be adapted for testing material of any description and of any desired form—tensile strength of bridge bolts, rope, wire, chain of any required length; transverse strain for girders, etc., crushing strain for columns, specimens of metals, stone, etc., as also for torsional strain.

For further particulars address Riehle Brothers, Ninth and Coates streets, Philadelphia, Pa., or 93, 95, and 97 Liberty street, New York.

Fig. 1



RIEHLE BROTHERS' TESTING MACHINE.

Fig. 2

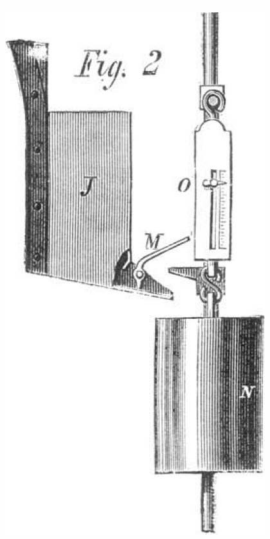
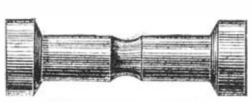


Fig. 3



ROUND TEST PIECE

Fig. 4

BOILER PLATE TEST PIECE

Junction of the Black and Caspian Seas.

An Italian journal, *L'Osservatore Triestino*, is responsible for the statement that the object of the recent visit of the Russian Czar to the southern part of his empire had particular reference to the projected junction of the Caspian sea with the Black sea. On page 336, Vol. XXV., of the SCIENTIFIC AMERICAN, attention was called to the same enterprise, and some of its difficulties and advantages were pointed out. We are now able to furnish the following additional details. The entire length of the canal would be 630 Russian versts, about 400 miles, though the mountainous chain to be pierced only measures eight versts, or about five miles. It is calculated that 32,000 laborers will have to be employed for fully six years in order to complete the undertaking. Quite apart from the direct commercial advantages which would result from the completion of this canal, it would serve to replenish the Caspian sea with water, a highly important consideration. During the last decade, and even longer, a remarkable reduction of water was noticed, so much so that the final extinction, that is, exsiccation of the sea, was apprehended. The results would not only be malarious in the extreme, but also destructive of a great source of wealth namely, the sturgeon, sterlet, and seal fisheries. Many thousand persons are at present employed in these fisheries (chiefly at Astrakhan), by whom 800,000 lbs. of caviar alone are annually obtained. An insurance of water supply to those persons would, therefore, give renewed stimulus to their local enterprise, though the same may not be nearly as important as the effect on commerce at large.

Delprino's Mode of Treating Silk Worms.

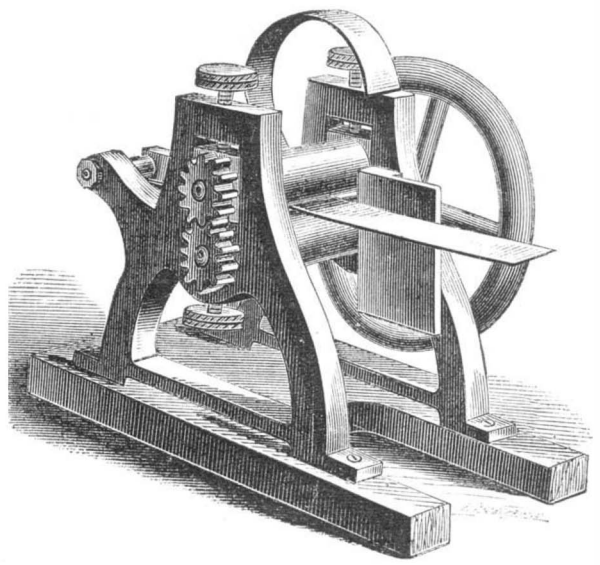
The attention of visitors to the Italian section of the French Exposition of 1867 was attracted to certain small wooden pigeon holes, each of which contained a silk worm, where it was occupied in constructing its cocoon without disturbance from its neighbors. This was an invention of Dr. Delprino, of Vesime, in Piedmont, and which, although very simple in itself, formed an important innovation in the art of raising silk worms. Since that time, this and other peculiar inventions of the same gentleman have been widely adopted, and have done much toward protecting the silk interest from the losses which the recent multiplication of diseases and other casualties have brought about.

The difficulty in the ordinary magnaneries, or worm houses, is that the worms are mixed together, the strong oppressing the weak, and heaped upon each other in a mass, so as to produce greater or less injury. In Delprino's system, a life in common is interdicted as much as possible, although during the feeding of the worms it is impossible to isolate them entirely. During that period they are kept together, but allowed ample room for moving about—being placed on small movable hurdles which can easily be changed. This produces constant ventilation, and prevents the danger of a great agglomeration, in consequence of which the transformations marking the different ages involve much less loss. When they have attained the proper period for transformation to chrysalids, the worms are placed in what Delprino calls the cocoonry, the pigeon holes (large enough to receive them) being placed on each side on tables, in which the worm is able to move about with freedom, and protected from injury. By the cocoon's not being attached to a branch, a saving of twenty per cent of silk is secured.

Another of Dr. Delprino's methods consists in securing a perfect union of the two sexes, and a more certain fertilization of the eggs. This is done by placing the fly in a cell covered with a board and keeping it there in darkness and solitude for half an hour, at the expiration of which, to each male is given a female, and the board replaced until the nuptial operations have been accomplished. By another arrangement every female lays her eggs separately, so that those of two individuals are not mixed, and so that the imperfectly matured eggs (such as can easily be detected by examination) can be readily removed and destroyed, thereby improving the general quality of the grains. The general idea of Dr. Delprino's system consists in the isolation of the insects, and although this may require a special arrangement and be somewhat troublesome, yet it is maintained that the result sufficiently vindicates the propriety of the process, and that in the greater perfection of the eggs, and the improved health of the worms, and better quality and quantity of the silk, there is a decided superiority in the new system.

MACHINE FOR BENDING PRINTERS' LEADS AND RULES.

This invention consists of a roller bending machine, in



which the adjustable bending roller is mounted in one end of a long swinging frame whose other end is at such distance from the roller as to allow of the wide range necessary for adapting the machine to form curves of any radii required for the leads and rules used in printing; and the said

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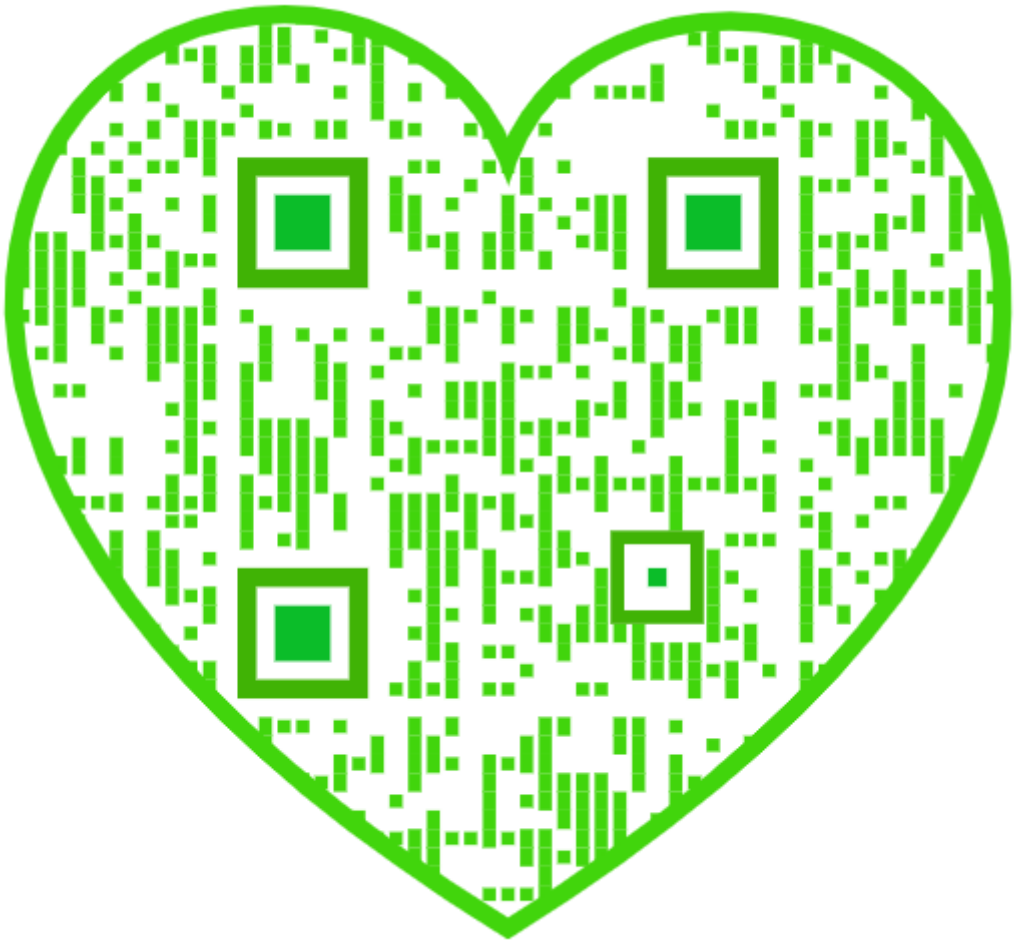

swinging frame is supported at the end next the rollers by the temper screw, by which it is adjusted, the whole being a simple and inexpensive arrangement.

Patented March 5, 1872, through the Scientific American Patent Agency, by Frank C. Smith and Henry McCollum.

G. P. Rowell & Co. 41 Park Row, New York, the celebrated advertising agents, have an interest in this invention, and will be prepared to supply the trade with the machines in a short time.

GUNMAKING BY MACHINERY.

The ordinary rough walnut stocks are used, being thoroughly dried before operated upon. The first operation is that of the

SLABBING MACHINE.

The stock is placed on a slide flatwise, and by means of a revolving disk, a straight cut is taken along that edge in which the barrel groove is eventually formed. This surface, which we shall call A, serves as a guide for the future work. Cuts are next taken across the "butt" and fore end to bring the stock to the standard length.

CENTERING MACHINE.

In this the stock is placed again on its flat upon a plate and pressed tightly against an iron form, which fits the face, A. Attached to the same plate, towards the butt end of the stock, is a slide fitted with four projecting points. By a blow the four points are driven into the butt end, making four holes in their proper relative position to the prepared face. A center is then bored with a small cone drill in its front end.

MACHINE FOR TURNING THE FORE END.

This machine comprises an iron form with a "center" to fit the front hole in the stock, a plate with four points to fit into the holes at the other end, which is drawn up by a screw clip passing over the end, and also a flat narrow plate running down the surface A. This form revolves upon two bearings, one placed near where the lock will be situated, being hollow to admit of the stock being inserted, and fitted with a screw to press the true face down on to the narrow plate, and another at the fore end. The stock is inserted in this, and screwed tight in the direction of the length of A. The narrow plate clears the cutters as they do their work. These cutters consist of a pair of revolving disks, fitted with hooked teeth and mounted on levers, pivoted near the ground line. An iron mold or copy of the fore end of the stock is placed below the latter—revolving slowly at the same speed. The levers carry friction rollers, which, as they travel over the irregular surface of the copy in a spiral direction, impart a corresponding motion to the cutters—and thus the form of the copy is repeated in the stock. A great economy of time is attained by using two cutters, one commencing in the middle while the other starts at the extreme end.

MACHINE FOR SHAPING THE BUTT END.

The general arrangement of this machine is the same as the one described above, excepting that the stock revolves on a center line, running nearly through the length of the butt, its fore end being passed through and clipped in a hollow tube supported at the farther end by an oblong face plate carried by a small spindle from which the rotary motion is given. There is only one cutting disk, and the cutting block is fitted with hooked cutter teeth of different forms, which are used successively for the roughing, middle, and finishing cut. The cutters revolve about 3,000 times a minute.

The next process is that of "spotting" the stock or preparing upon the sides certain perfectly true spots or planes, necessary in the accurate fixing required in the finishing machinery.

THE SPOTTING MACHINE.

In this machine the stock is held down by two spring clips upon a plate the width of the surface A. This plate works in vertical guides, and is made to descend by means of a treadle, thus bringing the stock into contact with seven small circular saws so disposed as to form the seven spots required, one on each side of the butt, one on each side of the extreme fore end, and three intermediate spots on one side. This completes the roughing process.

MACHINE FOR BEDDING THE BARREL IN THE STOCK.

The stock is inserted into a recess in a long movable table, which is caused to traverse by means of a rack and three pinions. To fix the stock in position, it is clipped at the five spots made on the long side, and pressed up against two horizontal clips, projecting a little over on each side of the top of the recess made to receive it, by studs from below. This ensures the stock being in line and level with the trued surface. On the further side of the table is a form or mold, similar to the barrel bed, and three upright revolving spindles fitted to a cross frame, with guide pins at their sides working in the form, which ensure their cutting out and following the proper shape in the stock. The spindle is fitted with a hooked nosed cutter. It is brought into position, and then lowered by a handle, the feed being given by rack and pinion. This process forms a taper groove, the full length of the barrel bed. The next spindle cuts the hole for the "breech pin;" the third, the bed for the tang. The groove receives the finished taper from a cutting spindle suspended from a cross bracket, which is vibrated by a handle, so as to follow the curve of the mold. The fifth and last process is to square the breech end of the groove. This is done by a horizontal revolving spindle which can be lowered into the groove. The fore end may be now cut to the finished length.

BEDDING THE LOCK.

This machine is complicated, carrying five small vertical cutter spindles in a frame revolving round a central axis. Each spindle is brought in succession to the work. The stock is fixed upon a slide, its position being regulated by a form against which the barrel groove is pressed. Alongside of the stock is an iron counterpart of the recess to be made, and each cutting spindle has, alongside, a tracing spindle, which is made to follow the said counterpart in all its details, the cutting spindle repeating the pattern in the wood of the stock. A fan and a couple of nozzles are used to blow away the chips, so as not to interfere with the cutters or the tracer. The first spindle cuts the recess for the lock plate, the depth being regulated by a cross bar on the tracer; the second, recesses for the screw heads; the third, the hole for the "sear" tang; the fourth, the recess for the mainspring; and the fifth, which carries a very small tool, finishes the same.

MACHINE FOR BEDDING THE TRIGGER AND GUARD.

This consists of an iron bed, with cast iron brackets on each side, connected by a horizontal bar which forms a bearing for the central axis of a revolving frame carrying four cutting spindles, very much the same as that used for recessing for the lock, and like it, provided with guide pins and levers having a vertical and horizontal motion. A similar arrangement has also been adopted as regards the driving strap, which runs horizontally above, and which can be brought down over any of the pulleys required as soon as they are in place. The stock in this case is secured in a vertical position, and is clipped in the manner before described. The frame or carriage to which it is fixed rests upon two bars of an irregular form. The carriage is moved by a rack and pinion, the rack being attached to the carriage. The first spindle being brought into position, where it is retained by a self acting stop, the tool is brought into contact with the work, and a forward curvilinear motion imparted to the carriage, thus making the recess for the guard. The second tool is then brought into play, which makes the recess for the "bosses." The third forms the screw holes, and the fourth, a deep recess required for the trigger, and also one for the ramrod stop. This machine, too, is fitted with a small fan and two blowing nozzles. Having cut out all the complicated figure required for bedding the lock and guard, and made a bed for the butt plate, the next process is to fit the fore end to receive the bands and "nose cap."

BAND MACHINE.

This is a very simple and effective machine, and consists of a low frame fitted with a "form," made to the barrel groove, and not to project so far forward as to interfere with the cut. This form is connected with cams, which are of similar shape to the bands, but of a larger size. It revolves in two bearings, and is fitted with a wooden hand wheel at one end, so that it can be turned round at pleasure. The stock is screwed down tightly upon the form, concentric with the hollow cams. Revolving cutter blocks are provided of the required width to cut the band and nose cap recesses. These cutter blocks can be brought forward at will, and are hung upon vibrating levers, weighted so as to cause them to lie away from the work, and fitted with treadles so that on the application of the foot they can be advanced at pleasure. All being ready, and the stock fixed in its place, the blocks are brought forward, and the man, having his hands at liberty, can turn the wheel round to give the required feed. The fore end of the stock has now to be finished to shape by rounding the parts between the bands.

THE MACHINE FOR CUTTING AWAY THE WOOD BETWEEN THE BANDS.

This is similar in many respects to the last, consisting of a barrel mold to which the stock is clipped, and vibrating cutters to follow a form. As the amount to be taken away is large, the length between each band is finished by two cutter blocks, one placed in front and one behind the stock. The front and back pair are alternately brought into action, and the whole length smoothed down and finished by the rotating motion given by the hand wheel. This does away with much of the vibration which would inevitably take place were the whole length of the cut taken at one time. All the tools and cutter blocks of these machines run at very high velocities, and the surfaces which they leave are very good, and in fact, a slight friction with a piece of glass paper, placed upon a cork rubber, is all that is required.

MACHINE FOR SECOND TURNING.

This machine consists of a strong cast iron open frame, with a planed top surface fitted with two long projecting fillets, on which slides a double head stock, with its connecting gear. Resting upon a plate, which carries its other extremity, is a hollow spindle for clipping the lower end of the forepart of the stock. This plate is moved along the fillets by means of a screw which is driven from a shaft running below. The cutter block is fitted with hooked teeth, and has a guard over it. It is also driven by the lower shaft, and the frame on which it vibrates is fitted with a light friction wheel which runs upon the form, revolving with a similar motion to the stock itself. To retain the sharp angles, the mold or form is at the corresponding points brought out so as to lead the cutter block beyond the flat surface, which, it should have been remarked, has already been produced by a simple planing cutter. By this means, the friction wheel can be allowed to travel over a rounded surface, which is a better motion for it, while at the same time the angles of the stock are left sharp. On taking the stock out of this machine, its outward form is perfect, but it has still to pass through two or three machines.

MACHINE FOR GROOVING FOR THE RAMROD.

This consists of a planed plate, working upon Vs and moved forwards by means of a rack and pinion. On this plate is fixed a mold to fit the barrel groove. The stock is clipped down to this, which ensures its position; and the first groove, which has parall l sides and a semicircular bottom, is cut in the fore end by means of a small cutter-block fitted with round nosed teeth. After this it becomes necessary to undercut it, and for this purpose a spherical tool is used, the spindle of which works through the top of the groove already formed.

MACHINE FOR BEDDING THE ROD SPRING.

This consists of a plate on which is bolted a form which fits the barrel groove. This is raised from its surface so as to allow the stock to bed horizontally. The tool for cutting the recess is horizontal, and we find here also the same arrangement of guide pin and mold to insure the right form being made. After the recess is cut, the hole for fastening the pin is made. The hole being very small, it has been found advisable to drill it from both sides, and this is effected by means of two vertical spindles with drills placed in line and running at great velocity. There are some other small holes to be drilled. This is done in a machine similar to the above, and the stock is then complete.

The above description refers more particularly to the stocking machinery used at Messrs. Tranters', of Birmingham, which is similar in many respects to the Enfield machinery. —*Mechanics' Magazine.*

To Cover Metallic Utensils with a Cheap, Durable and Lustrous Black Coating.

At the last Paris Exposition could be seen, in the French department, furnaces and ovens, covered with a lustrous and thin coating of lacquer, which could not be scratched off with the finger nail. Other metallic articles from Paris, such as steel for corsets, for example, possessed the same elastic coating, which, on heating, neither emitted odor nor became sticky. The perfect evenness of this lacquer and the absence of any marks caused by a brush gave rise to the supposition that it might have been produced in a way different from that of painting or dipping, and repeated trials in this direction led to the following method for producing this coating. The bottom of a cylindrical iron pot, which should be about eighteen inches in height, is covered half an inch with powdered bituminous coal; a grate is then put in and the pot filled with the articles to be varnished. Besides articles of cast iron, iron wire, brass, zinc, steel, tinned iron and pottery were subjected to the same treatment. The cover is then put on and the pot heated over a coke fire under a well drawing chimney. In the beginning the moisture only evaporates, but soon the coking commences and deep brown vapors escape, which irritate the throat. When the bottom of the pot has been heated for fifteen minutes to a dull red heat, the coal has been mostly converted into coke; the pot is then removed from the fire and, after standing ten minutes, opened for evaporation, all articles except those made of pottery being covered with the above described coating.

This lacquer is not only a protection against oxidation of metals, but will stand also a considerable heat, only disappearing at beginning redness; and therefore is its useful application for ovens and furnaces. Fine iron ware articles, such as sieves, are in this manner coated with remarkable evenness, which cannot be accomplished in any other way. Articles made of tin or soldered cannot be subjected to this process, as they would fuse. During the coking of the coal in the manner described, the peculiar smelling products of dry distillation, which we observe in the gas manufacture, do not make their appearance, and this is the cause of the absence of odor in the lacquer. If the heating be continued too long or too high, the coating will be of a dull blackness and not so elastic and durable. Smaller articles, like hooks and eyes, receive this coating by heating them together with small pieces of coal in a cylindrical sheet iron drum like that used for roasting coffee, until they present the desired appearance. These hints will be sufficient for every manufacturer to construct an apparatus suitable to his purposes.

STATE REPORTS.

The importance and worth of the reports made from time to time, by different State committees, commissions, boards of works, etc., is, we think, generally underrated. Many of these documents that reach us are filled with most interesting and valuable statements of facts, not only of use for present but for future reference. Of this character are now before us the Annual Report of the State Geologist of New Jersey for 1871, the Twentieth Annual Report of the Detroit Water Commission, and the Third Annual Report of the State Board of Health of Massachusetts, which have just come to hand. The statistics contained in the latter are a valuable contribution to sanitary science; and, were the lessons they teach better regarded, the public welfare would be greatly promoted. We shall, as occasion offers, place some of these facts before our readers, to the majority of whom these documents will not be easily accessible.

THE new German Empire wants a new structure for the Parliament of the nations. The architects of the whole world are invited to submit their plans and proposals at Berlin, on or before the fifteenth day of April. A prize of 21,000 francs is offered for the best project, and one of 4,500 francs for each of the four next best.

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TERRA COTTA.

Terra cotta in its application to architecture still has its advocates and opponents. When properly manufactured, it is one of the most durable materials which can be employed; but, like stone or any building material, it requires inspection before use.

Very fine specimens of terra cotta made in London one hundred years ago, and exposed to the weather since, are still perfect. In Northern Italy, many fine examples of brick and terra cotta exist, and the extensive revival in England and Germany of this method of building is worthy of note.

The strength of well made terra cotta is surprising. A piece of four inch column, made by Jas. Pulham and tested at the 1851 Exhibition, required a pressure of 400 tuns to the square foot to crush it, or as much as good granite, and two to three times as much as most building stone. In a paper recently read at the Architectural Conference in London, Mr. C. Barry gave some valuable results of experiments on terra cotta, showing the crushing strength of this material to be seven and a half times greater than that of average brick.

A simple test of the texture of terra cotta is the point of a pen knife, which should not penetrate the surface, and will sometimes strike fire upon it. A clear and bell like ring is also an evidence of homogeneity and compactness, and a clean close fracture shows strength. The texture of the body and the precision of the forms are further indications of accurate firing and homogeneous material.

The true qualities of terra cotta in its application to architecture consist in its merits as a decorative fire proof material, possessing the three essentials of color, durability and economy.

When treated with due regard to construction, so as to fulfil its part in the building as honestly as the brickwork of the wall itself, the high capacities of the material to receive artistic treatment admit of the impress of original art being reproduced for the uses of the architect, in an almost imperishable substance.

Fine works in hard stone are exceedingly difficult of execution, and in soft stone soon crumble away; the labor of the artist may be saved by taking a mold of his work, and reproducing it in terra cotta as often as may be required; indeed, the great economy in the use of terra cotta lies in producing a great number of articles of the same pattern.

Where original art is required, the subject can be modelled in the actual terra cotta clay, and passed through the kiln, from which it issues an original work of the sculptor, without the intervention of mechanical copying, molding, pointing or carving,

Modern examples of the extensive use of terra cotta are seen in the Dulwich School, (from designs by C. Barry, Jr.,) costing $500,000, and accommodating 700 boys; the Kensington and other Museums; various hotels and stores, and the great Albert Hall, which cost one million dollars. This building is of brick and terra cotta, contains seats for 8,000 persons, and is capable of accommodating 16,000 without discomfort. The same structures, decorated in stone, would have cost much more.

TERRA COTTA MATERIALS.

Terra cotta, or literally "burnt clay," would seem from its name to be very simple in its manufacture; yet to produce a material as strong, more durable, and less expensive than stone requires an exact scientific knowledge of the properties of many varieties of clay, and accurate observations upon their behavior in the oven.

In the terra cotta manufactures of the North of England and Scotland, the purest lumps of fire clay are selected by their color and texture, and used alone without any other clay, while the firms near London prepare more carefully a mixture of clays, which produces a body of better texture

There seems to be in every case advantage in using a mixture of clays, as a more compact, homogeneous, and better vitrified body is obtained, although at the cost of extra labor and care. One of the chief difficulties met in manufacturing terra cotta figures and ornamental works is the contraction the clay suffers after it has left the mold—first, in drying, and still more in the subsequent process of firing. By mixing the clays, a further advantage is gained in the diminished shrinkage, as fire clay terra cotta (that is, unmixed) shrinks in lineal dimensions about 12 per cent from the time it leaves the mold until it leaves the kiln; the mixed clay terra cotta shrinks 6 per cent or less, and red clays shrink 3 per cent.

To enhance the durability of the body of terra cotta, a partial vitrification of the mass is aimed at, by adding clays which, like the Dorset, contain a small amount of alkalies, which act as a flux to fuse the body harder.

Also vitrifying ingredients, pure white river sand, old fire brick ground fine, previously burned clay, called "grog," are added in various proportions, amounting even to twenty-five per cent. They counteract excessive shrinkage, act as vitrifying elements, and keep the color lighter.

The efflorescence of the alkaline salts in the clays, acting on the silicates of the surface, tend to vitrify more particularly the exterior of the block, and to form a harder surface, which should be left intact.

MANUFACTURE.

The mixture of clays is ground under an edge runner to the consistency of flour. The mills have either revolving or stationary pans; the former do the most work.

In order thoroughly to mix and incorporate the different clays, a subsequent careful pugging is required, for which hot water is sometimes used.

The mixture, when brought to the proper homogeneous consistency, is placed in a plaster mold, withdrawn, dried near the kilns or otherwise, and baked in a kiln for 5 to 7 days, during which time it is slowly brought to a white heat, and as gradually cooled down again.

In order to avoid twisting and warping during the firing, it is necessary, besides complete mixing of clays, that the mold be shaped so as to give a uniform thickness of material throughout; and if the temperature of the kiln be well graded, the homogeneous body will not warp.

To cheapen terra cotta building blocks, they are made hollow, and filled, during the construction, with concrete or cement.

Although in the kilns the products of combustion are separated from the wares, it is found that the use of sulphurous fuel darkens and tarnishes the surface, and it is to be avoided.

REPRODUCTIONS.

One of the advantages of terra cotta is the facility with which it lends itself to the reproduction at home of features of architectural merit, wherever found in distant countries. By taking on the spot a plaster cast of a detail of cornice, bracket, column, or other object, and sending this cast from abroad, it may be used for the reproduction of as many similar objects in terra cotta as the architect requires for a new building.

A practical difficulty is met in taking many casts from plaster cast, as it requires some skill, and deteriorates the model. This difficulty is overcome by the process of gelatin molding, as follows:

The plaster is coated with oil and soap, to prevent adhesion, and covered with a canvas for protection. Rolls of modeling clay are then laid on over the canvas, until the whole surface is covered to a suitable thickness, say 4 to 6 inches; and against this a plaster coating or wall is built up, in, say, two parts, to form a backing for the mold. The two parts are then opened, the canvas and clay are taken out and thrown away, the two parts are replaced, and a hollow interval of the thickness of the clay will exist, into which hot liquid gelatin is poured. After twelve hours, the gelatin will have attained a semi-solid elastic consistency, which will allow of the mold being opened and the gelatin impression peeled from the face of the model. The gelatin impression is replaced on the plaster wall which previously supported it, and a plaster cast is taken from it. From the latter, about four terra cotta reproductions can be made without sensible deterioration.

The advantage of gelatin is that it reproduces minutely without deterioration every mark of the plaster model; its elastic nature makes it especially useful for "undercut" carving, as it yields, while being released from the cut, and immediately again resumes its shape with perfect accuracy. —*Beckwith on Pottery.*

Leaden Water Pipes.

Lead is by far the most common material used in the construction of service pipes for water, and this metal is the one which is the most easily dissolved by water, and at the same most poisonous in minute quantities, being a cumulative poison. A celebrated case occurred in the royal family of France, at Claremont, where one third of the persons who drank of the water were affected. This water contained only one tenth of a grain of lead in a gallon. As little as one hundredth of a grain of lead to the gallon has been known to produce palsy in persons who habitually drank it. It is a great pity that the peculiar advantages of lead as a material for the manufacture of water pipes are more than counterbalanced by the danger of lead poisoning.

When the Croton water was first introduced into New York, it contained considerable lime, derived from the mortar of the recently constructed aqueduct. This prevented, to a considerable extent, the action of the water on the lead pipes, and it was stated at that time that no lead was taken up by the Croton water; but as the lime of the mortar became carbonated, the water ceased to dissolve it and began to act upon the lead pipes. Recently, the attention of the Metropolitan Board of Health having been called to the frequent cases of chronic lead poisoning which occurred in the city, I was requested to investigate Croton water which had been in contact with lead for different lengths of time, under usually occurring circumstances, of which the following are the results:

1. A gallon of Croton water from a lead lined cistern, in which it had stood several weeks, was found to contain 0·06 grain of metallic lead.

2. A gallon of water which had remained six hours in the lead pipes of my residence yielded 0·11 grain metallic lead, a considerable portion of which was visible to the eye, in the form of minute white spangles of the hydrated oxycarbonate ($PbO,HO + PbO,Co_2$).

3. Water drawn from one of the hydrants of the School of Mines laboratory, in the middle of the day when the water was in constant motion, yielded traces of lead. This water reaches the school through about 100 to 150 feet of lead pipe.

These results indicate the source of many hitherto unaccountable cases of lead poisoning, and are of a character to alarm the residents of New York, and to lead them to adopt precautionary measures for protection against this insidious cause of disease.

Certainly no pains should be spared to impress upon servants the importance of allowing the water to run for a few minutes before taking it for drinking or cooking purposes, especially early in the morning after the water has stood all night in the pipes. The habit of filling the kettle from the boiler, or of using water from the boiler for any purpose except washing, is very dangerous.

My second experiment explains a case which recently occurred in New York. An elderly gentleman was completely prostrated with paralysis or palsy. His physician at once suspected lead poisoning from his symptoms, and instituted inquiries which developed the fact that the patient had been using wheaten grits for dyspepsia, and that the first duty of the cook in the morning had been to soak them, preparatory to boiling them. She had therefore used daily the water which had stood all night in the pipes. The occurrence of a considerable portion of the lead in experiment No. 2, in suspension instead of solution, is an additional argument for the use of filters, though it will of course be useless to employ them unless they are frequently reversed, that they may be cleansed.

Manufacturers of lead pipe have frequently appeared in the New York papers with theoretical arguments to prove that the Croton water cannot possibly dissolve lead, but I believe that my simple facts outweigh folios of theory.

Various substitutes have been suggested for lead, as, for instance, wrought iron, which generally makes the water rusty; galvanized iron, which is said to be objectionable on account of the zinc, which is readily taken up by the water, rendering it unwholesome, numerous cases of zinc poisoning by these pipes having occurred in New England, where this pipe is much used; gutta percha, which is not durable; brass, which, I fear, is not wholesome; glass, porcelain, etc. None of these substances possess the peculiar flexibility, softness, and other desirable qualities of lead, which makes it so easy to cut and bend and join and fit pipes of this metal. The problem, therefore, is to provide a pipe which shall possess all the good qualities of lead, and be free from the one great objection, namely, the danger of lead poisoning from its use. This has been achieved by the invention of the lead incased block tin pipe, or, as some call it, the tin lined lead pipe.

I do not think this pipe is well adapted for hot water, as tin is very sensitive to heat, and should recommend that its use be confined to cold water. This is no objection, as the hot water from boilers should not be used for any purpose save washing.—*Professor Charles F. Chandler, in the American Chemist.*

Yaupon.

Yaupon is the name given by the Indians to the leaves of the *Ilex Cassine*, a plant indigenous to the Southern States, but found only along the coast, from Florida to North Carolina. Mixed with the leaves of other species of the same plant, *Ilex vomitoria* and *Ilex dahoon*, it formed "Cassena," the basis of their famous "black drink," which was used by the red men as a medicine, and as a state drink at some of their religious festivals.

Its constituents are, by analysis, as follows:

Volatile oil	0·011
Wax and tar	0·466
Resin	3·404
Chlorophyll	2·491
Caffein	0·122
Tannic acid	2·409
Brown coloring matter	4·844
Gum, pectin, etc.	8·244
Extractive matter	10·149
Extractive matter (starch, pictose. tannin, etc.)	15·277
Nitrogenous matter	8·138
Woody matter	34·854
Moisture	7·595
Ash	3·935
Total	101·939

The volatile oil has a very agreeable odor, perhaps faintly resembling that of raw tobacco, but having also a tea-like smell. The quantity obtained was too small to determine its physical characteristics, but it was quite soluble in water, and a very small quantity gave a decided odor to a large volume of that fluid. The large quantity of resin is worthy of attention, as it is probably derived in large part from the oxidation of the volatile oil; and it suggests that aroma and medicinal properties of the tea might be improved by a more careful preparation of the leaves.

The amount of caffein is small, ordinary tea containing 2·5 to 6 per cent. Stenhouse found 0·13 per cent in Paraguay tea (*Ilex Paraguayensis*) which agrees very closely with the amount found in Yaupon. A trace of caffein was found in the distillate, with the volatile oil, proving that this alkaloid is carried off mechanically when tea or coffee is boiled.

The percentage of tannic acid does not include that rendered insoluble by combination with legumin, etc.

The large amount of woody matter shows that the tea might be improved by more careful picking and manipulation of the leaves.

Yaupon is largely used in the South as a substitute for tea, coffee, and other stimulants; and it is reported to be very beneficial to inebriates who wish to cure themselves of their love of liquor.—*Henry M. Smith.*

GALVANIC BATTERIES.—The annual expenditure of the Western Union Telegraph Company for maintenance of galvanic batteries is over one hundred and twenty-five thousand dollars per annum. Any improvement, by which this immense outlay could be reduced without diminishing the supply of electricity or increasing the labor of maintenance, would be of value and importance. Here is a grand opportunity for students in electricity. A simple battery, more easy and economical to maintain than those now in use, is what is wanted.

TO ADVERTISERS.—We are receiving inquiries where loadstone can be purchased, also for spark and cinder arresters for chimneys, for machines to chip logwood, and for machines for sawing off stumps close to the ground.

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Sleep and Dreams.

While the functions of the tissues are in full activity, says Professor Humphrey, F.R.S., slight deterioration of structure takes place, which, affecting the voluntary system—the muscles and the hemispheres of the brain—causes the sense of tiring, and necessitates a period of rest for the restoration of the tissue to its former condition.

In the case of the muscles, this rest is provided for by periods, quickly alternating periods of action and cessation of action. But in the case of the brain, the actions upon which consciousness, volition, etc., depend, cannot be thus freely suspended. Their continuance is needed for the safety of the body during long periods, through the whole day, for instance; and longer periods are therefore required for repair. These are the periods of sleep.

Of the nervous system, it is the upper region of the brain which ministers to consciousness and volition, the intellectual operations, etc. And the functions of these regions not only can be long suspended without interfering with the action of the lower parts of the brain, which are more immediately necessary to life, but they are very easily suspended—slight causes, such as a jar or a shock, or an alteration in the blood current, being sufficient to stop the action of these parts and deprive the person of consciousness.

The spontaneous stoppage of their action, consequent on the slight deterioration of their structure from the continuance of their functions during the day, is the proximate cause of sleep during the night; and the periodic recurrence of sleep is in accordance with the periodicity observed in several of the nutritive functions, and indeed witnessed in many of the other operations of nature.

Dreams, Dr. Humphrey does not regard, as has been supposed by some, to be a necessary attendant on, or feature of, sleep, but rather to be the result of an abnormal condition. In the natural state, we should pass from wakefulness to complete unconsciousness, and *vice versâ*, quickly, almost instaneously; and many persons habitually do so. But the transition period is sometimes prolonged, and stages are observable.

The first thing that occurs is the lowering or cessation of that control over the mental processes which is the highest of our powers, the one requiring the greatest effort and the most easily lost. In this condition, the thoughts ramble unchecked, chase one another confusedly over the mental field, and give rise to all sorts of incongruities of the imagination.

At the same time, being unrestrained, they are excited, and evince efforts of memory, and even of combination, which, in the regular state of wakefulness, they are quite incapable of.

In this way the images of persons and places, of events and items of knowledge, long forgotten in the ordinary state, are recalled with distinctness, and we fancy that new information has been acquired when it is only forgotten facts that are recalled.

Some physiologists conceive that dreaming depends upon the inequality in the condition of different parts of the brain, some being excited or wakeful while others are quiescent or asleep; from this Dr. Humphrey dissents. He rather takes the view that all parts of the cerebral hemispheres combine in each of the efforts of control, consciousness, memory, and other mental acts, that all suffer alike from these effects, alike need the restoring changes which take place in sleep, and together *pari passu*, pass through the stages on the way to and from sleep, in which dreaming, sleep-walking, etc., occur.

The Uses of Ammonia.

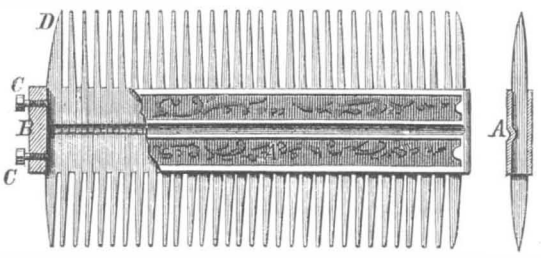
The *Country Gentleman* thus discourses: Spirits of ammonia are nearly as useful in housekeeping as soap, and its cheapness brings it within the reach of all. For many household purposes it is invaluable; yet its manifold uses are not as generally known as they should be. It is a most refreshing agent at the toilet table; a few drops in a basin of water will make a better bath than pure water, and if the skin is oily, it will remove all glossiness and also disagreeable odors. Added to a foot bath, it entirely absorbs all noxious smell so often arising from the feet in warm weather, and nothing is better for cleansing the hair from dandruff and dust. For the headache it is also a desirable stimulant, and frequent inhaling of its pungent odors will often entirely remove catarrhal cold. For cleansing paint, it is very useful. Put a teaspoonful of ammonia to a quart of warm soap suds, dip in a flannel cloth, and wipe off the dust and fly specks, grime and smoke, and see for yourselves how much labor it will save you. No scrubbing will be needful. It will cleanse and brighten silver wonderfully; to a pint of hot suds mix a teaspoonful of the spirits, dip in your silver spoons, forks, etc., rub with a brush, and then polish on chamois skin. For washing mirrors and windows, it is also very desirable; put a few drops of ammonia upon a piece of newspaper, and you will readily take off every spot or finger mark on the glass. It will take out grease spots from any fabric; put on the ammonia nearly clear, lay blotting paper over the place, and press a hot flat iron on it for a few moments. A few drops in water will clean laces and whiten them finely; also muslins.

For cleaning hair and nail brushes it is equally good. Put a teaspoonful of ammonia into one pint of warm or cold water and shake the brushes through the water; when the bristles look white, rinse them in cold water, and put into the sunshine or in a warm place to dry. The dirtiest brushes will come out from this bath white and clean. There is no better remedy for heartburn and dyspepsia, and the aromatic spirit of ammonia is especially prepared for these troubles. Ten drops of it in a wineglass of water are often a great relief. The spirits of ammonia can be taken in the same way; but it is not as palatable a dose. Farmers and chemists are well aware of the beneficial effects of ammonia on all kinds of vegetation; and if you desire your roses, geraniums, fuchsias, etc., to become more flourishing, you can try it upon them, by adding five or six drops of it to every pint of warm water that you give them; but don't repeat the dose oftener than once in every five or six days, lest you stimulate them too highly. Rain water is impregnated with ammonia and thus it refreshes and vivifies vegetable life. So be sure and keep a large bottle of it in the house, and have a glass stopper for it, as it is very evanescent and also injurious to corks, eating them away.

JOHNSON'S RENEWABLE TOOTH COMB.

We illustrate herewith an improvement in combs, the advantage of which to manufacturers is that the material may be worked up much closer than in the old way, and that, at the same time, a tasty and graceful appearance may be given to the article. To consumers, it offers the advantage that, when any of the teeth are broken in use, they may be easily replaced, at a very small expense as compared to that of the purchase of a new comb.

Fig.1 *Fig.2*



In the engraving, A represents the plate of the comb, formed of a piece of sheet metal doubled and confined at the ends by a block or end piece, B, in which the screws, C, work. The end teeth, D, extend entirely through, as shown.

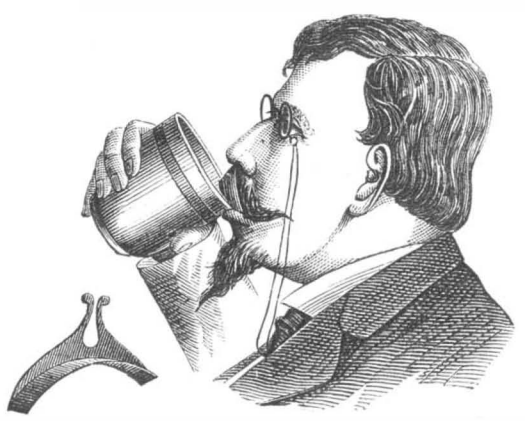
The middle of the plate, A, has impressed in it an indentation or groove formed lengthwise and constituting a rib in the inside, or a ledge upon which the bases of the teeth abut, the butts of the teeth being notched to fit the ledge.

The teeth, being inserted as shown, are firmly held by turning up the screws, C. When a tooth breaks, it may be replaced by loosening the screws, inserting the tooth in its proper place, and then turning up the screws again.

The invention was patented through the Scientific American Patent Agency, January 30, 1872, by Orange Johnson, of Grand Ledge, Mich., who may be addressed for further information.

MOUSTACHE GUARD.

In these days, when an unshaved lip is the rule, except among clergymen, it is hardly necessary to dwell upon the advantages or disadvantages of the moustache. Suffice it to say that, in our changeable climate, physicians are agreed that it conduces to health; and the inconvenience it offers, to the imbibation of the various fluids with which the human animal regales himself, has not been found sufficient to destroy the favor with which this popular hirsute appendage is regarded. In fact, it may be questioned whether it is not looked on with feelings of envy by certain strong-minded individuals of the sex to whose faces Nature has denied the manly attribute of beard.



The man who has invented a means, whereby those "bearded like the pard" may sip their wines, mixed drinks, and the milder beverages which "cheer but not inebriate," may justly be ranked in the long list of the eminent benefactors of mankind; and in virtue of his having conferred this inestimable boon upon mustachioed humanity, we therefore record, among the latest and brightest of these benefactors, the name of Eli J. F. Randolph, of New York, who patented (Feb. 20, 1872), through the Scientific American Patent Agency, the device which is illustrated in the accompanying engraving.

The nose has long been employed to support eyeglasses and spectacles. It is said it was once employed by a celebrated musician to execute a note, inserted by an ingenious joker, in a piece of music, the exigencies of which extended the hands to the ends of the keyboard, while the note in question required the manipulation of a key in the middle.

Surely the nose, after having performed such a feat, must be equal to the keeping of one's moustache out of one's mush and milk, when provided with a proper instrument for the purpose.

Such an instrument is provided in Mr. Randolph's invention. It is a curved plate, of hard rubber or other suitable material, adapted to the form of the upper lip, so that, being suspended in front thereof, the flange will take under the moustache, and hold it so as not to interfere with eating and drinking. Kissing, although not claimed in the patent, might perhaps also be rendered more easy and satisfactory by its use.

The plate has two curved prongs with rounded edges, so as not to injure the parts with which they come in contact, and adapted to enter the nostrils and suspend the plate from the thick part of the nasal septum, by grasping the latter, the prongs being inserted at the front of the septum, and pressed backward till they get a good hold.

The moustache is thus held, as shown in the engraving, with the attendant advantages above set forth.

Tungsten Compounds.

Professor Roscoe, F. R. S., recently read a paper, before the London Chemical Society, "On the Study of some Tungsten Compounds." He had prepared and examined a number of tungsten compounds which appeared to establish definitely that this element had the atomic weight 184. Four chlorides had been obtained, WCl_6, WCl_5, WCl_4, and WCl_2, of which the first three corresponded to the oxides WO_3, W_2O_5 and WO_2. The hexachloride, a solid crystalline substance, was formed by passing chlorine over heated metallic tungsten prepared from pure tungstic acid, taking great care to exclude moisture and oxygen, which would give rise to the formation of oxychlorides. In order to obtain tungstic acid pure and free from sodium, it was found necessary to convert the acid from commercially "pure tungstate of sodium" into the ammonium compound, which was then repeatedly crystallized; the presence of even a trace of sodium is easily detected in tungstic acid, as when ignited, it acquires a green tinge from formation of some lower oxide of tungsten, whilst the acid in a pure state is of a yellow color, without any shade of green. The vapor density of the hexachloride, taken at 440°, gave numbers considerably too low for the atomic weight 184, whilst, at 350°, the results corresponded to it, showing that at the higher temperature dissociation or decomposition took place, which was confirmed by the fact that, when the hexachloride was heated to a high temperature in a current of carbonic anhydride, chlorine was taken off. This tungsten compound may be crystallized from carbon bisulphide, and is not deliquescent when quite free from the pentachloride and oxychloride. The pentachloride WCl_5 which is also crystalline solid, was obtained from the hexachloride heating it in a current of hydrogen and then distilling off the volatile pentachloride from the non-volatile tungsten compounds containing less chlorine formed. At the same time, tungsten tetrachloride and tungsten dichloride are not crystallizable. Tungsten oxychloride, $WOCl_4$ and tungsten dioxychloride, WO_2Cl_2, both crystalline compounds, have been known for some time: the former forms scarlet needles and laminæ; the latter is pale yellow. Professor Roscoe has also examined the two bromides, the pentabromide and the dibromide, and believes that a tribromide exists, although he has as yet been unable to isolate it. Tungsten pentabromide was most conveniently prepared by passing carbonic anhydride, saturated with bromide vapor, over heated metallic tungsten. It forms very dark colored crystals which undergo slight decomposition when kept, bromine being liberated. The dibromide is not crystalline. He had also prepared and examined the dioxybromide WO_2Br_2, the oxybromide $WOBr_4$, a substance crystalling in red needles somewhat resembling potassium chlorochromate, and the diiodide WI_2, which is the only iodine compound of tungsten he had succeeded in obtaining. From numerous analyses of these different compounds, and from vapor density determinations, Dr. Roscoe has succeeded in establishing that tungsten is a hexad, and, from careful determination made with the hexachloride, has found the atomic weight to be 184·04. Tungstic acid, being exceedingly difficult to obtain in the pure state, gave a slightly lower number. A series of very fine specimens of the substances were exhibited.

Professor Roscoe further said that the splitting up of the hexachloride under the influence of heat showed that the pentachloride could be formed without the use of hydrogen; moreover the highest tungsten compound of bromine known, the pentabromide, which was quite analagous to the pentachloride, was formed directly from tungsten and bromine without the intervention of hydrogen.

Poisonous Hair Dyes.

With but few exceptions, all the concoctions, sold for the purpose of "restoring" the color of the hair or for dyeing the hair, contain the salts of lead, a deadly poison, highly injurious to the health when applied to the scalp or other portions of the body, even in minute quantities. Professor Charles F. Chandler, of Columbia College, N. A., has examined a variety of these preparations; and, in each fluid ounce of the following popular articles, finds lead as follows:

Clark's Distilled Restorative for the Hair	0·11
Chevalier's Life for the Hair	1·02
Circassian Hair Rejuvenator	2·71
Ayer's Hair Vigor	2·89
Professor Wood's Hair Restorative	3·08
O'Brien's Hair Restorer America	3·28
Gray's Celebrated Hair Restorative	3·29
Phalon's Vitalia	4·69
Ring's Vegetable Ambrosia	5·00
Mrs. S. A. Allen's World's Hair Restorer	5·57
L. Knittel's Indian Hair Tonique	6·29
Hall's Vegetable Sicilian Hair Renewer	7·13
Dr. Tebbett's Physiological Hair Regenerator	7·44
Martha Washington Hair Restorative	9·80
Singer's Hair Restorative	16·39

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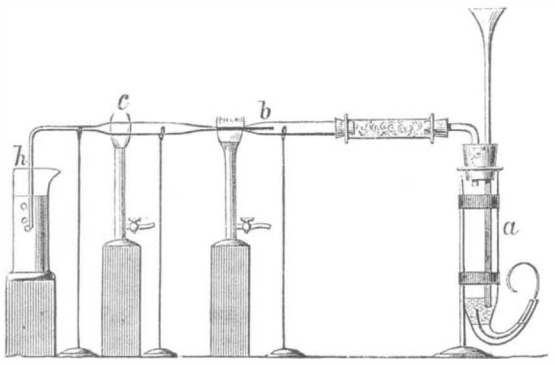
THE QUANTITATIVE DETERMINATION OF ARSENIC.

BY JOHN C. DRAPER, M.D., PROFESSOR OF CHEMISTRY, UNIVERSITY MEDICAL COLLEGE, NEW YORK.

In a paper in the last number of the SCIENTIFIC AMERICAN, attention was directed to the difficulty of completely separating arsenic from the arsenide of hydrogen by the action of heat; it is my purpose in the present paper to show that this may be accomplished in the most satisfactory manner by the introduction of a faggot or bundle of platinum wire into the reduction tube.

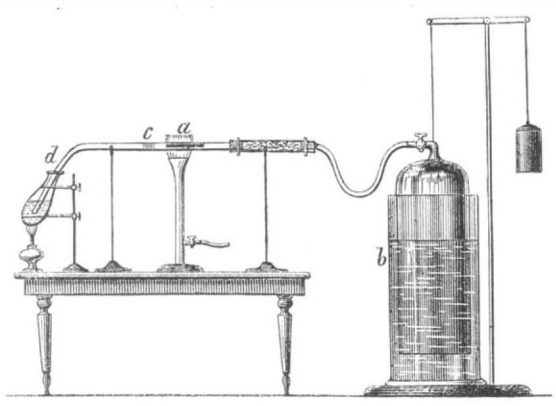
Many explanations of the action of the platinum will at once suggest themselves, but it is probably owing to the ease with which this metal unites with arsenic, especially in an atmosphere of hydrogen; at all events, I may for the present accept this hypothesis in the description of the process I am now to lay before the reader.



The arrangement I have employed may be described as a modification of the reduction or ignition tube of the hydrogen apparatus, *a*. It consists of a hard lime glass tube, *b c*, one quarter of an inch in diameter and drawn down at *b* to form a tube about two inches long and one tenth of an inch in diameter. A weighed faggot or bundle of clean platinum wire, about two inches long and made of ten or a dozen pieces of the metal, is then dropped into the narrow portion of the tube, *b*, which it should fit closely in the manner shown in the figure. The end *h* of the tube is drawn down and bent to deliver the escaping gas into a dilute nitrate of silver solution.

A sufficient quantity of hydrogen gas having been evolved in the decomposition flask to fill the whole apparatus, a flame is applied at *c*, and if, after passing the gas slowly for half an hour, no deposit of arsenic appears in the narrow tube between *c* and *h*, the materials may be considered as being sufficiently pure. A Bunsen flame, from an elongated opening $\frac{1}{16}$ of an inch wide and one inch long, is then applied at *b*; and the arsenical solution is introduced into the decomposition tube, *a*. After a few moments, a change may be noticed in the hot platinum faggot, its exterior becoming rough and crystalline from the deposition of arsenic; and even though the arsenical solution be very strong and the rate of evolution of the gas quite rapid, the precipitation of the arsenic is complete, no trace of a deposit appearing at the second flame and the silver solution remaining unchanged.

After the whole of the arsenical solution has been introduced into the decomposition tube, the gas may be passed over the hot platinum for an hour, when its freedom from arsenic may be tested by removing the flame from *b* for a few moments. If any arsenide of hydrogen is still passing, its presence is indicated by the appearance of a stain at *c*, and the flame must be restored at once at *b*. Moving the flame, *c*, nearer to the bend of the tube will drive the stain to or beyond *h*, and leave the portion at *c* ready for another trial test. The use of the second flame, *c*, is therefore to test the purity of the materials at the outset, to show that the operation of



the platinum faggot is going on satisfactorily, and also to enable the experimenter to determine when the evolution of the arsenide of hydrogen ceases.

All the arsenic being thus deposited on the platinum the faggot is removed from the tube; its weight is again determined, when the increase will represent the quantity of metallic arsenic that has been precipitated on it. The conversion of this by a simple calculation, into its equivalent of arsenious acid, completes this portion of the operation.

The next step is the actual transformation of the arsenic, on and united with the platinum, into arsenious acid, in which form it may be either kept or employed for the application of other tests. The method, by which I have accomplished this, is to heat the platinum faggot in a tube, *a c d*, through which a current of dry oxygen is passing from the gasometer, *b*. In an atmosphere of this gas, nearly the whole of the arsenic is volatilized from the platinum at a dull red heat as arsenious acid, which recondenses at *c*. A small portion of the arsenious acid is drifted on towards the open end of the tube, but this may be arrested if necessary by passing the escaping gas through water which is kept boiling at a moderate rate in the flask, *d*.

When the formation and volatilization of the arsenious acid is completed, the tube may be cut through the middle of the stain, *c*, and the portion, *c d*, divided into small pieces and placed in the flask, *d*. To the solution thus formed other tests may be applied.

Not only is the use of the platinum faggot applicable in medico-legal investigations, but it may also be employed for the quantitative determination of arsenic in many metals and their ores. For this purpose, various methods will be required in the treatment of such materials before they can be introduced into the decomposition flask; but these will readily suggest themselves to the practical chemist.

Improvement in Saws.

This invention consists in having the back formed of a bar or rod of iron, preferably round, with one end fitting in a hole in the handle, so as to shift forward and back, with a nut screwing on to it against the handle to force the back outward, to strain the saw, which is connected to the handle in the ordinary way, the other end of the back being extended to or toward the outer end of the saw blade, and connected to it for straining it. The rod or bar forming the back is not grooved, and the back edge of the saw is let into it, as in the case of the ordinary back saws, but is intended to fit as snugly against the side of the back rod as it may and be free of it.

The principal object of the invention is economy in the expense of the construction; but it has other advantages which will be pointed out.

This mode of attaching the back to the wood handle is claimed to be much cheaper than the connection of the ordinary flat back, for the hole is formed by boring, while a recess or cavity must be worked into the handle, by chisels, for the flat back, which requires much more labor and time. The flat backs are very expensive to make, whereas in this invention any suitable bar or rod of the right size is completed by forming the screw thread for the nut and shaping the outer end for connecting the saw blade to it, both of which are simple operations.

Again, when the back is formed in the old way, the saw, being placed in the groove in the back for it, is secured by hammering the sides of the back to pinch them upon the blade to hold it. This warps and buckles the saw to a considerable extent, for it is impossible to hammer the sides alike throughout their length, and this buckling of the saw must be hammered out after it is connected to the back, all of which is avoided by this improvement.

When the saw is once connected to the back in the old way, it cannot be disconnected for filing and setting, which is objectionable because the back and the handle interfere with placing the blade in a vise or clamp for filing, or on a plank in a setting apparatus for setting; whereas, by this plan, the pin being removed, the blade can be wholly detached, or be swung away from the back on the screw to be placed in the vise.

After the wood handle has shrunk, the blades get loose and shift about in the handle so as to interfere considerably with doing work well by them, when connected in the old way; whereas, when arranged according to this improvement, they can be kept tight by the adjusting nut, although the handle shrinks to any extent it is liable to.

The back may be adjusted readily for saws varying considerably in length, for it may extend into the handle more or less within a considerable range of variation.

This invention has recently been patented by Mr. Joseph Holden, of Middletown, N. Y.

Waves of Sound and of Light.

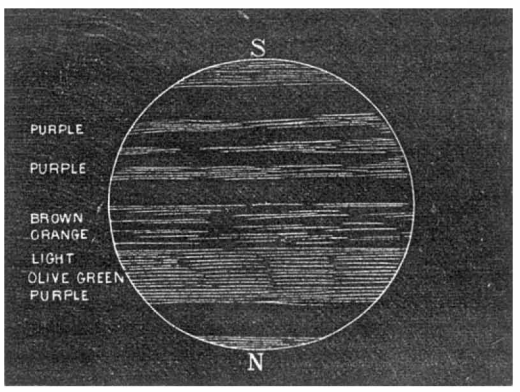
In the case of a sound wave—moving 1,100 feet a second whatever the wave length—if the length be diminished, more vibrations enter the ear in the same time and the pitch rises; if it be increased, less vibrations enter, and the pitch lowers. Light waves are strictly analogous; whenever any one of the colored waves which form white light is lengthened, its color changes toward the red end of the spectrum; when it is shortened, toward the violet. Hence change of pitch in the case of sound, or of color in the case of light, is evidence of motion, either to or from the observer; which it is, depends on whether the wave is lengthened or shortened. Now, while the motion of a star at right angles to the line of sight is easily detected and measured by the telescope, motion in the direction of this line is capable of measurement only by the spectroscope; if the motion be diagonal, then by both of these instruments together. Hence the motion of a fixed star in space, or of a whirlwind on the sun, may be measured by the change, in refrangibility, which certain lines in the spectrum undergo.

To illustrate this point by means of sound waves, Professor Mayer, of the Stevens' Institute, has originated a new and beautiful experiment, which he recently employed in a lecture before the scientific department at Yale College. With the lantern, the image of a tuning fork beating 256 times a second—and giving the note Ut_3—was thrown on the screen. By the side of one of the prongs, and just touching it, was a carefully rounded and varnished cork ball, suspended by a filament of silk. On sounding a second fork placed on its case, and tuned in accurate unison with the first, anywhere in the room, even 30 feet distant, the first fork was thrown into vibration and the image of the cork ball was projected on the screen a foot or two away from the prong. When, however, the second fork was sounded, and the lecturer walked rapidly—at a rate of 8 feet a second—towards or from the first, touching the case only when in motion, no motion of the cork was observed; the wave being in this way shortened or lengthened by an amount sufficient to throw it out of unison with the lantern fork. Again, a third fork, vibrating 254 times a second, produced no effect on the ball; but when sounded and placed on its case, as this was swung rapidly toward the first fork, the wave length was thereby so shortened as to bring it into unison with this, and the ball promptly responded. A fourth fork, vibrating 258 times, showed the same phenomenon, when placed on its case as this was swung away from the first fork, the wave thus being shortened into unison. The demonstration was most complete and satisfactory. Professor Mayer stated that he purposed making some quantitative experiments with the apparatus, which will be of the highest value to science.

THE PLANET JUPITER.

This planet is receiving a good deal of attention from astronomical observers.

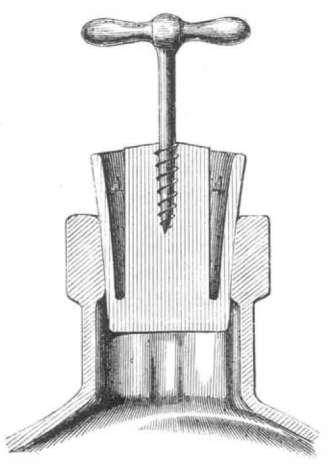
W. Lassell, Esq., ex-President of the Royal Astronomical Society, has just published, in the Transactions of that learned body, some remarks upon this subject, with a sketch of the planet as seen by him in his 2-feet Newtonian reflector with powers of 260, 430, and 579. These observations were taken on the interesting occasion of a transit of the fourth of the satellite across the planets disk, when the satellite appeared almost as black as if it were a shadow transit—a striking proof of the exceeding brilliancy of the planet's surface. But this was not the phenomenon that appeared most striking in the rare and exquisite view of Jupiter, but rather the distinct presence of color on the disk, sufficiently marked to overcome previous skepticism. Mr. Lassell deems it an advantage of a Newtonian reflecting telescope, when the alloy of the specula is well compounded, that colors of the planets are more faithfully represented than is possible in refracting telescopes, which, not being perfectly corrected for chromatic aberration, generally introduce a modifying tinge.



In the same number of the proceedings of the Royal Astronomical Society, the Astronomer Royal makes a suggestion that one observatory shoud be permanently devoted to observations of the phenomena of Jupiter's satellites. In advocating this proposal, Professor Airy points out that the theory of the movements of Jupiter's satellites is perhaps the most interesting among the planetary applications of the theory of gravitation, especially in the remarkable enchainment exhibited in the movements of the three interior satellites.

WRIGHT'S BOTTLE STOPPER.

The object of this invention is to provide a bottle stopper which may be inserted and withdrawn an indefinite number of times without injury, and which shall be homogeneous in texture and uniform in its elasticity.



The stopper is made of a block of wood, in which is turned a deep annular groove, A, by which the outer bearing of the stopper forms a more or less elastic and flexible ring, according to the nature and thickness of the wood. The stopper is preferably made of soft pine, poplar, or other soft elastic wood. The lower end may be saturated or covered with varnish or other suitable substance to close its pores and prevent the evaporation or escape of volatile liquids.

A hole, B, is formed in the center for the insertion of a screw, by means of which the stopper is withdrawn. This device was patented, through the Scientific American Patent Agency, Nov. 14, 1871, by Wendell Wright, of Phœnicia, N.Y.

MALLEABLE IRON CASTINGS.—A correspondent wanting a few hundred pounds of malleable iron castings informs us that he has written to every foundery that he knows of, and is frequently informed that they have on hand orders to last them for the next three or four months. He states his belief that if he could find a maker of malleable iron castings who is too poor or too stingy to advertise, and who consequently is in want of customers, he could get his orders filled promptly. This seems to be a good business for enterprising people to engage in.

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Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

Saws and Files, and their Manufacture.

To the Editor of the Scientific American:

A short sojourn at Johnstown, Fulton County, N. Y., has given me the desired opportunity of visiting the Cayadutta Works, a large saw and file manufacturing establishment in this place, and to inspect some machines and processes, a brief description of which may interest some who daily use those useful articles, but who have never witnessed the making of them.

In the saw department, almost all kinds of saws are made, circular, cross cut, hand, wood, butcher's and kitchen, the last three being the specialty.

As a type of all, let us trace the steps by which sheets of steel, 18 by 30 inches, and two inch birch, maple, or ash plank are converted into the well known red jacket buck saw, which bears on the bright blade the company stamp, The Livingston and Cheritree M'f'g Co., and on the frame, the device of a bow and arrow.

By a strong power shears, the sheets of steel are cut into strips two and one fourth inches wide. For toothing, the blade is then fixed upon the bed, or table, of the toothing machine, on which one edge is made to pass steadily beneath a V shaped punch, by which the teeth are cut more rapidly than one can count. The toother used was made here, has toothed as many as sixty dozen saws in a day, and is valued at $650. The punch leaves a burr on one side of the teeth, which is "knocked down" by passing the blade under a small trip hammer. The saws are next taken to the hardening shop, where they are first heated in an oven until the color indicates sufficient heat, the best steel requiring to be brought to a light blue color, the poorest to nearly a straw color, intermediate qualities of steel requiring different shades; so that great skill is necessary in the operator. From the oven, the saws are plunged into a vat containing a mixture of oil, beeswax, etc., from which they come out hard indeed, and almost as brittle as glass. They are then heated again to a certain extent and allowed to cool slowly, which gives a spring temper, so that they can be bent double without breaking. The smithing process follows, in which the saws are straightened with hammers on steel faced anvils, after which the whole blade is ground and then smoothed on emery wheels. After another heating to perfect the temper, and the removal of the blue color which this heating gives with acid, they are set and filed in the ordinary way, by hand, when they are ready for the frames, to the making of which we will now attend.

In the company's mill the logs are cut into plank. These are cut with a circular saw into pieces of the proper length for the several parts of the frame, namely, the handle, head and cross bar. The pieces are then marked by patterns and sawn with gig saws. Each piece is next split with a small circular saw. After drying for several months, they are run through an ordinary planer, which brings them to one thickness. The next process is the most interesting of all. It is called burring, which means the rounding of the edges and ends of the pieces which form the frame. It is done by a wonderful little machine, not much larger than an ordinary sewing machine, the invention of Mr. John W. Millet, the machinist of the establishment. It consists of four wheels, about eight inches in diameter, three of them having a V shaped edge, which runs in a groove in the edge of the fourth. Two of the V edged wheels are on shafts which are made to revolve by belts running to the main shaft. The third is above these, and the fourth, or groove edged one, is supported by the other three in the center of the triangle formed by them. It is turned by the friction of the two wheels, below it, on which it rests. This wheel in the center has a hole in its center, some two and one half inches across. On the inner edge of the wheel, knives are set. The pieces of wood to be burred are shoved through the center of this wheel and are thus rounded. The advantages of this machine over all others are that it is perfectly safe and can be run at one third of the expense. The double head burrer, in use here before the invention of this one, could only be used by a strong and skillful man, and is charged with having cut off eight or ten fingers. This can be run safely by any boy of fifteen. After being burred, the frames are smoothed and polished by Whitney's smoothing machine, the edges smoothed on a sand wheel, mortised for the cross bar, and grooved for the saw. The peculiar feature of these saws is the brace which connects the upper end of the head piece with the center of the cross bar. It is the invention of the President of the company, Mr. Wm. H. Livingston. The strainer and brace are one continuous rod, extending from the swivel at the top of the handle, through an eye at the top of the head piece, to the center of the cross bar. Of these brace saws, which are made nowhere else, there are four grades, distinguished by the color of the fastenings, and named respectively red jacket, blue jacket, green jacket and black jacket.

The peculiar features of the butcher saw made here are the stiffener, the mode of fastening to the handle, and the buckle by which all the parts are held in place. The complete saw consists of the blade, back, stiffener, buckle, and handle. To form the back, a groove is cut with a small circular saw lengthwise in an iron rod, into which groove is fitted the stiffener, a strip of steel the length of the saw, an inch or more in width, and about one eighth inch thick. The rod, which projects some six inches at each end of the stiffener, is bent without heating over the ends of it, to a curve at one end and a right angle at the other. Through a hole in the handle, the right angled end of the rod passes flatwise, and is secured by the buckle, a small triangular prism which serves as a nut at the end of the rod, no rivets being used in the handle. One end of the blade is fastened by a rivet to the outer end of the rod which forms the back. A short rod fastened to the other end passes through a hole in the buckle, and is secured by a nut, by which the saw is tightened. A vertical slit in the buckle receives the end of the blade.

The kitchen saw consists of three parts only, the blade, back, and handle, the back passing through the handle, and the blade being riveted at both ends, the spring of the back giving sufficient strain to the saw.

Various other saws are made, but in the ordinary manner.

Besides the burrer, described above, there are several curious machines in use here, also the invention of Mr. Millet, by each of which hundreds, if not thousands, of dollars are annually saved. Among them are two eight inch circular saws, run by one shaft and so placed as to cut off at once and at the proper bevel both ends of the cross bar of the buck saw. A little toothed and grooved wheel cuts the tenons at the end of the cross bar, leaving the shoulder to fit the rounded edge of the frame. With a little machine, which can be made for $25, a small boy bends the rod which forms the brace and strainer and forms around it, at the angle, the eye by which it is fastened to the head piece. With a pair of long handled gouges set in a frame, the round at the upper end of the handle is cut.

Seventy-five kinds of machines are used in this factory, and the full force of men is about 250. 20,000 dozen saws can be made in a year, and the company intend to make 10,000 buck saws in 1872.

Files are first forged from bars of steel by smiths, on anvils, then annealed by heating and straightened, after which they are cut by hand with chisels. They are then covered with a kind of paste, the exact composition of which is a secret of the trade, which protects the teeth during the hardening process. They are hardened by dipping in hot lead and, when brought to a cherry red heat, plunging in salt water.

This factory has six forges and twenty-nine blocks for cutting, and is thought to be one of the best arranged establishments in the world.

The celebrated McCarthey cotton gin for the long sea island cotton is manufactured here.

The Cayadutta Works are named from the stream which furnishes the power by which they are carried on, about 108 horse power. They were founded, in 1863, by Wm. H. Livingston, the President of the company, to whose kindness I am indebted for so favorable an opportunity to visit the establishment and learn the details of the business.

I forgot to state that a new plan is about to be tried for sawing out the frames without the tedious process of marking by a pattern.

Johnstown, N. Y. CHAS. H. DANN.

Coating Cast Iron with Other Metals.

To the Editor of the Scientific American:

In response to your article, page 165, current volume, I will submit the following:

In plating iron with tin and other metals, the first thing to be done is to prepare the iron for plating; any fault or neglect in this will cause a total failure. First, then, cleanse the articles to be plated from sand, dirt, smoke pitch, grease, etc., by immersing them in dilute sulphuric acid for about fifteen or twenty minutes; then scrape, file, scour, or grind the parts to be plated until bright and smooth; then, if the articles are small, take a camel's hair pencil, if large, a flat camel's hair brush, and apply dilute muriatic acid to the parts to be plated, taking care not to get any on other parts Next take an iron pot, and put into it a sufficient quantity of tin, or whatever metal is to be used; place the pot over a steady fire, and, when the contents are quite melted, dip the articles into the melted tin, taking care to scrape to one side any scum or dirt which may collect upon the surface of the melted tin, so that nothing but pure melted tin can come in contact with the articles dipped. If the articles are of any considerable size, it will be well to plunge them into cold water when taken from the pot of tin. The work having been well done, the articles will now be thoroughly coated where they were scoured and washed with acid, while no tin will adhere to the other portions. All that now remains to be done is to rub down any lumps and ridges, which may have collected here and there, with a soldering iron, and then polish with a burnisher, and the work is done.

Other metals besides tin, such as zinc, lead, etc., may be used; or a compound of metals, such as pewter, etc., can be applied by melting the hardest first, and adding the others, one at a time, until all are in and well mixed; but the zinc must be added last, if any is used, because it is most easily injured or burned.

The practice of covering the melted mass with a thin layer of tallow, when a lengthy process is to be performed, is to keep the tin from hardening or scumming over, and not to affect the process of tinning in any way; and care must be taken that no grease comes in contact with the articles when dipped; the sweat from the hands of the workmen is sufficient to prevent the tin from adhering to the iron.

St. Albans, Vt. CHARLES THOMPSON.

Shaving with Pumice Stone.

To the Editor of the Scientific American:

I am of a very inquiring mind and derive a great deal of comfort from reading your valuable paper. Anything novel or strange in science or the arts is sure to attract my attention.

I was more than usually interested in the communication on shaving with pumice stone. Visions of bankrupt barbers and a total revolution in the tonsorial system arose before my fervid imagination. I could not rest until I had tried this wonderful means of keeping down the human stubble; accordingly I procured two nice pieces of pumice stone and prepared them as directed; and, after a half hour's work on a week old stubble, I have—a chapped face. To say I am disappointed but feebly expresses my feelings. I have heard of very young men shaving with a towel, but I am convinced this sand paper arrangement is a fraud. The joke would have had more point if your correspondent had deferred publishing it until the 1st of April. A VICTIM.

Macon, Ga.

["Victim" must be thin skinned, or the result of his shaving with pumice stone, if skillfully used, would have been more satisfactory. It is a favorite mode of shaving in Havana, and we know of persons in this city who employ it. A celebrated physician told us the other day that he was in the habit of polishing off his face with pumice stone before going out in the evening, having used the razor in the morning. On persons of thick skin, and stiff beard before it has grown to much length, the result of the pumice stone shave, we have his authority for saying, is most satisfactory.—EDS.

City Disinfection.

To the Editor of the Scientific American:

In an article in your paper of March 9 on "City Disinfection," you quote the remark of Professor Liebig that "the coming generation will consider those men as the greatest benefactors of mankind who devote all their efforts to utilise and save the night soil of the cities," and mention a patented method of Mr. Dotch for disinfecting night soil, consisting of the application of a prepared earth, containing clay and sulphuric and nitric acids, which is spread in thin layers over the fresh feces. Without questioning the value of this patented method, it occurs to me that Nature has provided in illimitable quantities a substance, which is very accessible and cheaper than any prepared or invented, which will accomplish the desired object instantaneously and add its own valuable properties to those of the disinfected feces. This substance is dried peat, to be reduced to an impalpable powder by the action of frost or by passing it through a threshing apparatus. By spreading this substance in thin layers over the fresh feces, all offensive odor is seized as quickly as thought and held; and the decomposed vegetable matter of the peat, added to the feces, makes a manure of the greatest value which can be handled without the least possible offence. It is adapted to the utilizing of both solid and liquid excrements. The city of New York, by adopting a system of earth closets and the use of this unpatented method, cannot only convert what is now a nuisance and the source of malaria and consequent sickness into a substance of incalculable value to the agricultural interests of the country, but also make it a source of revenue to the city. Besides, the adopting of this system will dispel all fears of a failure of the supply of Croton water to the present or increased population of the city. R.

GEOLOGICAL REPORT FOR NEW JERSEY.

We are indebted to Professor George H. Cook, State Geologist, for his 1871 report. From it, we learn a great deal of information concerning the mineral products of this State. In some portions of the State, mines rich in magnetic ore are being constantly discovered and are extensively worked. The product last year, according to Professor Cook, amounted to 450,000 tuns, more than four fifths, about 370,000 tuns, coming from Morris county alone. The mining of hematite ore in New Jersey is limited to a few localities, and the total product is estimated on good authority to be only 15,000 tuns for last year. The zinc mines of New Jersey have yielded about 22,000 tuns of ore during the year. Of arsenical ore, Professor Cook says:

"During the past season, specimens of so called silver ore have been extensively circulated at Hackettstown, and in the neighboring villages of Warren and Sussex counties, the localities whence they came being kept secret. A single lump of what was said to be the same as the 'silver ore' was obtained from the ridges on the east side of the Jenny Jump Mountain, and was analyzed and found to be an ore of arsenic. The specimen yielded 15·60 per cent of sulphur, and 29·80 per cent of arsenic. Mineralogically, it is arsenopyrite or mispickel, with probably some löllingite, but the specimen was too small to determine the latter with certainty. In the report on the mineralogy of New York, Dr. L. C. Beck mentions this arsenical ore as occurring in crystalline limestone near Edenville, Orange county. The geological character of the latter locality is very similar to that of these subordinate ridges of Jenny Jump Mountain range. The analysis of the New Jersey specimen indicated traces of cobalt and nickel, but no silver could be detected. It is probable that the traditions of silver ore on this mountain are based upon these arsenical pyrites. This ore, associated with other combinations of arsenic, nickel, cobalt, iron and sulphur, is worked in Saxony, and extensively at Reichenstein, in Silesia, as a source of metallic arsenic, arsenious acid, or white arsenic, the pigments realgar and orpiment, and for other arsenical compounds used in the arts. The extent of the occurrence and the character of this ore are matters to be more fully studied, before deciding upon its probable value."

On road making, the Professor states that, in the city of Orange, N J, trap rock has come into use, for making roads, with the most satisfactory results. The material is hard and tough, and the roads made of it are solid, smooth and durable, and, for their excellence, of moderate expense. They are so

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well liked that their use is extending rapidly. Several miles are already built. It is known as the Telford pavement, and is described as follows :

"The roadway to be excavated, graded and properly leveled to a depth of sixteen inches below the top of the gutter stone; the form of the cross section to be in every respect the same as that to be given to the surface of the pavement. The road bed is then to be rolled with the steam roller until approved by the Street Commissioner. On the road bed thus formed, a bottom course or layer of stones, of an average depth of eight inches, is to be set by hand in the form of a close firm pavement, the stones to be placed on their broadest edges, lengthwise across the street, and so as to break joints as much as possible; the breadth of the upper edges not to exceed eight inches. The interstices are then to be filled with stone chips, firmly wedged by hand with hammers, and projecting points broken off. The whole surface of this pavement to be subjected to a thorough setting or ramming with heavy sledge hammers. The intermediate layer of broken stone is then put on to the depth of six inches, the stones to be broken, to a size not exceeding three inches diameter, and thoroughly rolled down with the steam roller; after which the surface layer of broken stone, of a size not exceeding two inches in diameter, is to be put on and evenly spread to such depth as may be required to bring the surface, when thoroughly compacted with the steam roller, to the proper grade and cross section; making the total depth of broken stone eight inches, and the entire thickness of the pavement, when completed, sixteen inches. Any irregularities appearing during the rolling are to be carefully filled with additional material, so as to produce an even surface. When the surface is thoroughly rolled, a binding, composed of the screening and *detritus* of the broken stones with sand, is to be spread thereon, sprinkled, and thoroughly and repeatedly rolled with the steam roller until the surface becomes firm, compact and smooth. Any binding material remaining on the surface is then to be swept off and removed. For the foundation, any stone not liable to be affected by the action of the frost may be used after having been approved by the Street Commissioner. The broken stone in the intermediate and surface layers to be exclusively of trap rocks.

"When the traffic is lighter over the road, the broken stone may be thinner—down to twelve or even ten inches, and the breadth may be less—sixteen or twenty-four feet. The cost of these roads varies with the distance to which the broken stone has to be hauled. That in Main street, Orange, which is sixteen inches deep, cost $1.90 a square yard. Center street, which is paved thirty feet wide and a foot deep, cost $2.50 a running foot. The road going up the mountain is twenty feet width of pavement, and from eight to twelve inches depth of stone, and was built for one dollar a square yard. The road from the stone breakers, on the Northfield road, for a mile down, was graded and paved for a dollar per running foot. The contract for paving High street, Newark, was let for $1.90 per square yard, which was probably too low. Other contracts for like work have been taken at $2.25 to $2.50 a square yard. The stone is broken in a Blake's rock crusher; and, when driven by a ten or twelve horse engine, ninety tuns or sixty cubic yards can be broken in a day. Daniel Brennan, jr., of Orange, has done a large part of the work there, and his arrangements for doing it are very complete. He quarries the stone near the top of the First Mountain, and the breakers are so located that the carts dump the stone close to them, and the broken stones are elevated, sorted and deposited in proper shoots by machinery, and wagons are driven directly under the shoots and the stone falls into them, thus needing no handling. The excellence and economy of these roads is such that I am sure that it will be a great public benefit to have them more thoroughly known. I do not think that better stone roads can be found anywhere in the world than these in Orange; and it will be worth while for any who are considering the subject to go and see them.

"Trap rock is abundant in all the middle portion of the State. Bergen Hill, and its extension to the Palisades, is of this rock, so are the First, Second and Third Mountains west of Newark extending from Pluckemin and Somerville to Paterson and almost to the State line. Rocky Hill, Mount Rose, Sourland Mountain, Goat Hill, Pickle's Mountain, and manysmaller outcrops in the red sandstone region are of this same rock. The gneiss and gray rocks of the Highlands furnish a good material for stone roads, but not equal to the trap. The stone is not so tough, and it wears into dust much faster. Limestone is still a softer rock, and, of course, is not so well adapted for this purpose."

SCIENTIFIC AND PRACTICAL INFORMATION.

THE COMET HYPOTHESES.

M. Faye recently read to the French Academy two papers, in which he summarized all the theories which have as yet been given to the world on the nature of the comets. He attacked, with some satire, Sir William Thomson's view, given to the British Association at its meeting for 1871, that the comet's tail still remains an insoluble mystery. M. Faye asserts that the tails of comets are the effect of the repulsion of the sun; and he has supported this view by argument and experiment, stating that all white hot bodies exert a repulsive force on extremely rarefied matter, and exhibiting the repulsion of rarefied air by a white hot metal plate. The experiment, considered by M. Faye to be a conclusive demonstration of the correctness of his view, was differently interpreted by the spectators, who were some of the most eminent scientists in France; and various opinions as to the cause of the repulsion were given. We may reasonably expect that the spectroscope will enlighten us on this matter, as it has done already on many other phenomena, scarcely believed to be within man's powers of explanation and analysis.

THE LAND OF OPHIR.

Herr Karl Mauch, now travelling in southeastern Africa, has recently forwarded to Dr. Petermann, of Gotha, editor of the *Mittheilungen*, a remarkable account of the gold mines, of great wealth and antiquity, of Sofala, a maritime province lying between Mozambique and the territory of the Transvaal republic. Dr. Petermann publishes a most interesting circular, from which we extract the following :

"For many centuries, authorities have inquired into the true locality of the land Ophir of the Bible, whence King Solomon, 3,000 years ago, obtained immense masses of gold, ivory, and precious stones. Some have placed it in Eastern Africa or Southern Arabia; others thought it to be in the East Indies or in Sumatra; still others even in the West Indies or Peru. It is certain that they must have been very rich mines from which the gold came.

When, in the fourteenth century, the Portuguese came to Sofala, they found there rich gold mines, worked from time immemorial, and near them ruins of structures which, according to native traditions, were built by Queen Saba. Lopez, the historian, records that the natives pride themselves on possessing books which testified to the Ophir cruises of Solomon. From Arabic writers (Mabudi, Edrisi, etc.), we know that this trade was continued throughout the middle ages by the Arabs, who, frequently, from the Persian Gulf came as far south as Sofala.

"The German traveller, Karl Mauch, undertook last fall an excursion to Sofala for the purpose of exploring the mines and the monuments of antiquity. His discoveries consist of ruins, walls, some of which are thirty feet high, fifteen feet thick, and 480 feet in circumference, a tower, etc. The fact of all of them, without exception, being of hewn granite, put together without mortar, testifies to a high antiquity; and the drawings of the ornaments prove that they do not originate from the Portuguese or from the Arabs, but from Phœnicians, the Solomonic Ophir cruisers.

"The present population has been there but for about forty years. The ruins are sacred to them, and they all believe that whites have once lived in this region. Such would appear to be true from the ruins of houses and the iron vessels found there, which cannot have been the works of the blacks.

"Whether or not this land may finally prove to be the biblical Ophir, it is at least sure that what has been found thus far establishes the probability of its connection with the Solomonic Ophir cruisers. Voyages from ports in the Red Sea along the coast of Eastern Africa were within the means of the navigation of that age, and the time of three years, said to be used for the voyage both ways, would also correspond.

"In short, to the quartz gold fields, the alluvial gold discovered by Burton and Mauch, and the steadily increasing yield of the diamond fields, there seems now to be added, in Southern Africa, also the Ophir land of Solomon. An archæological expedition directly to Sofala harbor, and hence about one hundred and sixty miles west into the interior, would soon throw light on this question. In the meantime we may expect, with each mail, new reports from Mauch."

DIVING IN MINES.

In the coal mines of Westphalia, it has been resolved, after much experimenting, to organize an instructed corps of divers for operating in mines of which the levels or shafts are flooded. In conjunction with some one of the several subaqueous lamps which have been described in our columns, the diving bell or dress will enable many mines to be cleared of obstructions, pumps to be repaired, and lost tools and other property to be recovered. In the mines in question, a descent was made into a shaft containing 80 feet of water, and the bottom was cleared of *débris*. An abandoned shaft of the same mine was examined; the pumps were discovered to be in good condition, and, new valves being supplied, they were set to work and mining was at once resumed.

THE FORMATION OF FIBRIN.

Among the many marvels of organic existence, the origin of the fibrous form of animal matter has long been a question widely discussed and a puzzle, the solution of which has evaded the most penetrating observation. Dr. John Goodman, who last year read a communication on this subject before the British Association for the Advancement of Science, has now published the following results of his investigations into the conversion of albumen into fibrin, a process which has met with some acceptance as a credible answer to the question of the nature and genesis of the fibers of flesh:

1. Albumen, from the egg, suspended in ropes in cold and pure water, and exposed for some little time to its influence, loses its character of albumen, and assumes the nature, appearances, and constitution of fibrin spontaneously. Thus, it coagulates, independently of the application of heat, and becomes solid and insoluble—characteristics which distinguish fibrin from all other analogous substances.

2. Under the microscope, when thus transformed by water, it exactly resembles blood fibrin, with the reactions, etc., of which it was constantly compared. So great was the resemblance that a medical gentleman selected this substance under the microscope for the real genuine blood fibrin, in preference to a specimen of the fibrin substance itself.

3. Blood fibrin and especially this substance, differs from albumen in possessing intense attractive powers and affinities, which appear to be the secret cause of the formative qualities of fibrin; causing it to form, in definite lines, into rods and substances, etc., which evince the presence of a controlling constructive power, and enabling it to assume forms and grotesque figures, of which it might be said that nothing but vitality was wanting to endow them with the character of living beings. In several instances, the fibrin from albumen manifested decided electrical attraction, for it was drawn aside and out of its perpendicular, in several instances, some ¼ inch or so, by attractive influence toward a copper wire when raised from the water. On the other hand, albumen presents itself as a homogeneous, motionless, and shapeless mass, and entirely destitute of these powers and characteristics.

4. Like blood fibrin, it was found to decompose peroxide of hydrogen with effervescence, while albumen produces no such effect. Again, Dr. Miller tells us that neutral salts, mixed with blood, on abstraction, prevent its coagulation. This we found to be the case with regard to this substance—even sea water prevented, in a great measure, the transformation.

ELISÉE RECLUS.

In our number of March 16, we called attention to the case of this eminent geographer, and we are glad to hear that the French government has commuted his sentence to one of exile from his native country. The administration of M. Thiers is thus spared the shame of sacrificing one of France's worthiest sons to a political idea; and M. Reclus will be enabled to pursue his labors, and perhaps to learn that no political success or distinction can confer a glory comparable to that which surrounds the smallest discovery of scientific truth.

THE COMING DESTRUCTION.

While we have endeavored to calm the fears of some of our impressible contemporaries, whose alarm at the impending collision has lately been so widely exhibited, *Nature* regrets that the rumor of an approaching comet is without foundation. "In the present state of science, nothing would be more acceptable than the appearance of a good large comet, and the nearer it comes the better, for the spectroscope has a long account to settle with the whole genus, which up to this present time has fairly eluded our grasp. But it is not too much to suppose that the laymen in these matters might imagine that discovery would be too dearly bought by the ruin of our planet. Doubtless, if such ruin were possible, or indeed probable—but let us discuss this point. Kepler, who was wont to say that there are as many comets in the sky as fishes in the ocean, has had his opinion endorsed in later times by Arago, who has estimated the number of these bodies which traverse the solar system as 17,500,000. But what follows from this? Surely that comets are very harmless bodies, or the planetary system, the earth included, would have suffered from them long before this, even if we do not admit that the earth is as old as geologists would make it."

Decline in Prices of Farm Stock.

According to a recent report of the Department of Agriculture, a very extensive decline in the prices of domestic animals has taken place within the past year. The following are the current rates, as compared with last spring:

HORSES, OVER THREE YEARS.	1872.	1871.
New Jersey	$148·57	$163·21
Georgia	113·29	129·45
Ohio	102·28	102·92
Kentucky	89·67	96·35
Illinois	88·26	93·93
Texas	46·23	45·52
MULES, THREE YEARS AND OVER.	1872.	1871.
Georgia	$130·00	$139·86
Tennessee	119·12	128·00
Kentucky	112·89	115·14
Illinois	107·95	114·44
Texas	67·60	73·60
COWS.	1872.	1871.
Massachusetts	$39·87	$59·16
New York	39·53	48·51
Pennsylvania	39·16	46·67
Ohio	37·36	45·09
Michigan	36·86	41·15
Illinois	33·77	37·68
Iowa	28·49	34·31
Missouri	25·85	31·92
Kansas	30·77	38·46
Tennessee	22·83	23·57
Georgia	20·81	21·61
Texas	14·12	12·83

The prices of oxen and other cattle have heavily declined in the Eastern States during the year, owing to scarcity of fodder. In the Middle States the decline is less, and at the South still less.

Hogs have also greatly declined. The prices this spring in the Western States are from thirty to fifty per cent less than last year. Hogs over one year old sell now in Ohio for $9·07 against $12·97 last year at this time. In Illinois, at $7·48, last year, $12·71.

Sheep are the only farm animals that have advanced. In Vermont, the price of a sheep not less than one year old has advanced since last spring from $2·75 to $4·56; New York, $3·37 to $4·32; Ohio, from $2·49 to $3·37; Texas, $1·59 to $1·73.

THE Russians seem to resume our abandoned experiments in the use of liquid fuels for steamboats and locomotives. An engineer, Proviecki, is reported as having made successful experiments in that line. Should the plan succeed, it will doubtless lead to considerable saving in money, as a case of naphtha—the liquid employed—weighing 40 lbs. only costs one copeck—equal to one cent—at the Caucasus, while coal is of course much more expensive.

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Earth Boring Auger.

The old method of digging wells, post holes, etc., required the excavation of from two to three times the amount of earth absolutely necessary for the desired opening. The method of boring, on the contrary, leaves the excavation nearly or quite the exact size wanted, and is, therefore, much more economical of labor, besides that it makes a much neater job.

Our engraving illustrates an earth auger, which may be applied to opening post holes, or on a larger scale, as shown in the engraving, to boring wells, for which latter purpose it is claimed to possess superior advantages. Its construction is extremely simple, and will be readily understood.

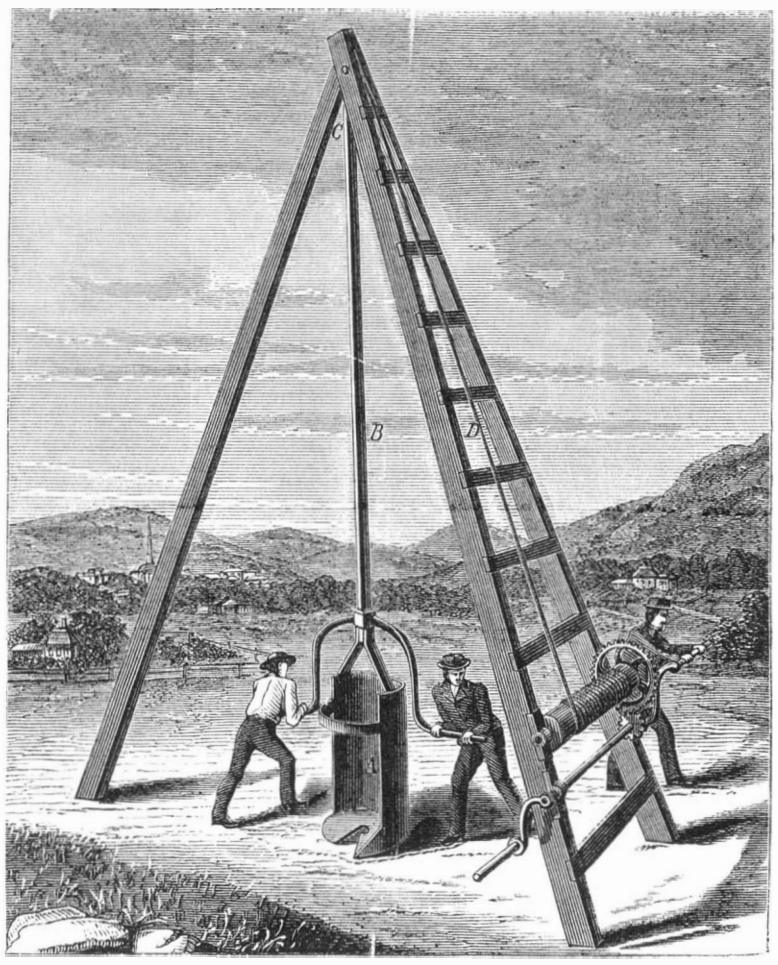
A is the auger, having a suitable lip at the bottom, made of cast steel by a peculiar process which enables it to be hardened on the edge, or not, as desired for special kinds of work. It is in form a section of a cylinder, slightly flattened on one side so as to allow air to pass by it when it is withdrawn with its charge of earth. It also has near the top a band of iron, extending over the open side, which serves as a support for plastic soils when the charge is taken out. A section which completes the cylinder may be hinged to the one shown, which is necessary sometimes in certain kinds of boring.

From the auger proper rises the shank, B. This shank is swiveled at the top, C, to the rope, D, of a derrick, by which the auger is raised or lowered: upon the shank, B, is placed a bent lever, so attached at the middle that it may be adjusted up or down on the shank, and through the action of which the auger is turned in boring.

When the auger is filled by the excavated earth it is raised, turned into a horizontal position, and its contents discharged. Water in suitable quantity is poured into the excavation to lubricate the auger, and to aid in compacting the charge, the flattened side of A preventing a vacuum from forming below the auger when it is being withdrawn.

When large flat stones are met with, they are broken by a suitable drop, when the auger seizes the fragments, and brings them up with the excavated soil. It is further claimed that, with this auger, and by tubing as the work proceeds, a well can be successfully sunk in quicksand.

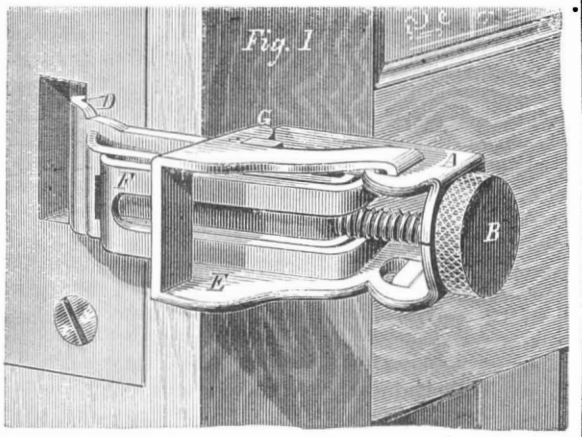
The invention was patented, August 1, 1871, through the Scientific American Patent Agency, by William Wheeten Jilz, of Saint Joseph, Mo., who may be addressed for further information.



JILZ'S EARTH BORING AUGER.

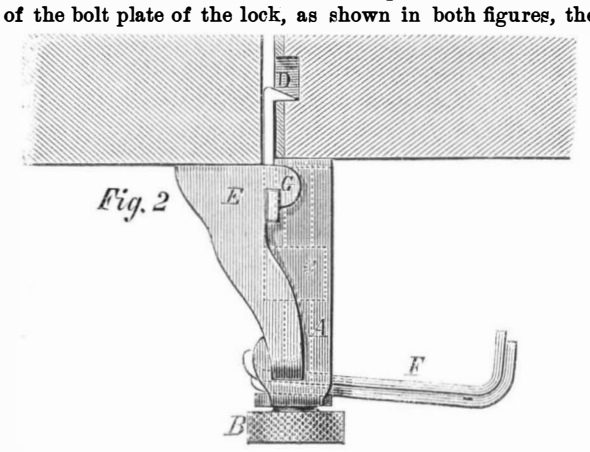
MELENDY'S DOOR FASTENER.

This little device seems to us to meet the requirements of a good door fastener more fully than anything of the kind we have met with. It is very cheaply made, and holds the doors to which it is applied very securely, without marring



the casement. It consists of a body, A, Figs. 1 and 2, of strong sheet metal, which carries a strong adjusting screw, B. The screw plays in a nut, C, shown in dotted outlines in Fig. 2, and formed on the end of the strong claw, D, Figs. 1 and 2. To the body, A, is loosely pivoted the bracket, E, Figs. 1 and 2. The parts lettered F are called compensators, and their use will be subsequently described.

Now to fasten the door, the claw is placed in the mortise of the bolt plate of the lock, as shown in both figures, the



pivoted bracket being turned back, so that the door will pass it in closing. Then the door being closed, as shown in section in Fig. 2, the bracket is turned down into the position shown, slipped back on its pivots so that the hook, G, engages lugs formed on the body, A, and the screw is then turned until the bracket abuts firmly against the door, as shown in Fig. 2.

The compensators, F, when not needed, are slipped back, as shown in Fig. 2; but when the crack between the edge of the door and the casing is too wide to hold the claw firmly, one or both of them are placed in position, as shown in Fig. 1, so as to fill up the space and press and hold the claw firmly into the mortise of the bolt plate when the door is closed.

When a door is unprovided with a lock, the claw may be made to engage the wood or a crack in the joining of the casement, in which last case the casement will not be defaced. It is small, and convenient for travelers to carry in the pocket.

Patented March 12, 1872, through the Scientific American Patent Agency, by B. H. Melendy, whom address, for further information, box 125, Amherst, N. H.

Prizes for Chemical Inventions.

The following is a list of prizes offered by the Prussian Society for Industrial Advancement, at Berlin, for discoveries to be realized in practical science:

1. The gold medal of the Society, or its value in specie, and the sum of 3,750 francs to the inventor of an exact and rapid method of separating the several ingredients of the anilin of commerce, both as to quantity and quality. The same would also have to show the influence of the several compositions of anilin upon their manufacture and their transformation into fuchsin, and to examine and clearly indicate the conditions under which anilin will furnish the greatest proportion of coloring material.

2. The silver medal, or its value, and the sum of 1,125 francs for an opaque red enamel, applicable to gold, silver, copper, or bronze.

3. The sum of 925 francs to the author of the best criticism on the deficiencies in the present methods of composing cement.

4. The silver medal, or its value, and the sum of 560 francs to the author of a profound essay on industrial fabrication, the mode of forming and the chemical constitution of coralin (aurin, rosolic acid, peonin) and on the blue color of azulin prepared therefrom.

5. The silver medal, or its value, and the sum of 1,875 francs to the inventor of a yellow solder, possessing the properties and quality of ordinary tin solder, and to be used for soldering brass or similar alloys so that the seams will not be visible.

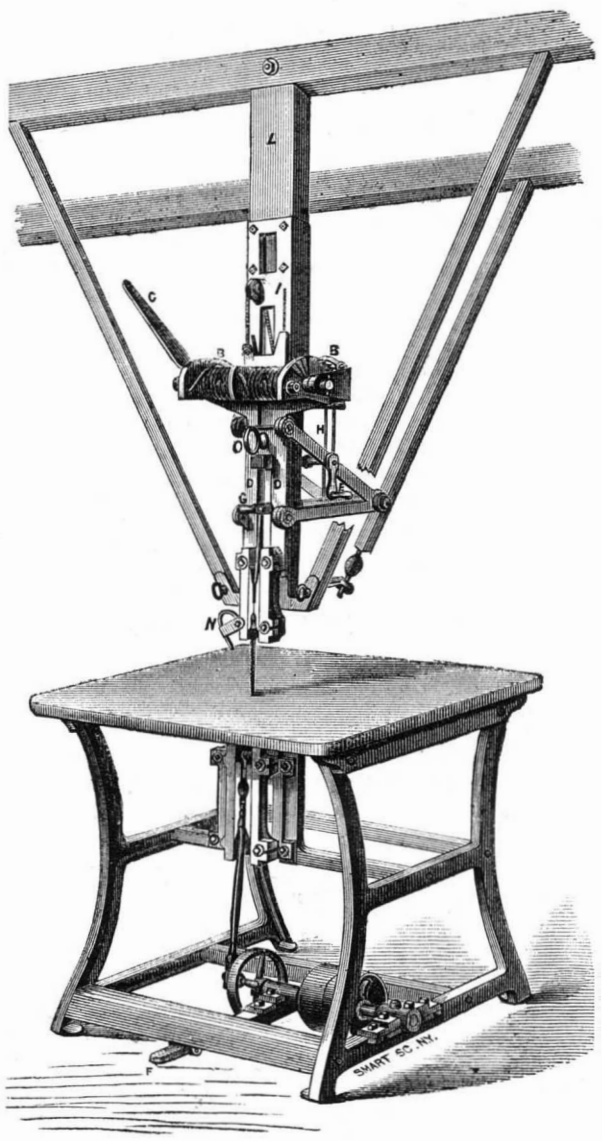
BEACH'S SPIRAL SPRING SCROLL SAWING MACHINE.

Our engraving illustrates the construction of a spiral spring scroll sawing machine, which, at the Fair of the American Institute last season, elicited general praise on account of the high speed at which it can be run without jar, its general convenience, and the facility with which it can be operated. The saw can be run at from 800 to 1,000 per minute without jar. The two springs employed give from 10 to 75 lbs. strain on the saw, while the average movement of the coils is but one sixteenth of an inch. The motion of the springs being so slight, the variation in the tension on the saw is less than one eighth of a pound, thus enabling the lightest saw to be run without breaking. The raising and lowering of the springs, with all their connections, bring the lifting power of the springs directly to the top of the saw no matter what its length. The simple and complete mode of changing the tension of the saw allows it to be done in a moment of time, without stopping the machine. The construction of the springs and their connections with the saw, is so arranged as to bring the strain of the saw in a direct line with the bolt, fastening the machine to the joist overhead, so that, if the three braces shown in the cut are removed to leave it suspended upon one single bolt, it does not shake enough to jar the machine when running 1,000 motion.

In the engraving, A represents two spiral springs, made from Jessup's best imported English steel. Each spring contains ten coils of one half or five eighths round steel rod, one being a right hand, the other a left hand coil. One end of each of these springs is firmly fastened to the ratchets, B, the opposite ends to the front end of the lever, F, which is supported upon the shaft passing through the center of the springs, and so constructed that there is no friction whatever upon any part of the springs when in motion. The link, H, which is of iron, connects the upper lever, F, with the lower lever, G. These levers are so connected that, when the saw is moving a five inch stroke, the first coils of the springs, A A, move but one eighth of an inch, the second coils but one ninth of an inch, and so on down to nothing, making the average movement of the coils but one sixteenth of an inch. The upper crosshead, which carries the top of the saw, is firmly connected to the lever, G, thus making a positive connection between the saw and springs. This insures a perfectly rigid strain on the saw. By means of the ratchets, B, and lever, C, any amount of strain can be given, from ten to seventy-five lbs., according as it is a small or large saw. This is done by taking hold of the lever, C, which is inserted into the side of the ratchets, B, and thus winding or unwinding the springs, A. Each spring and ratchet is independent of the other, so that one or both springs can be used. The tension on the saw by this means can be changed in a moment, while the machine is in motion. A plunger pump is attached to the inside of the iron plate, D, with a rubber pipe running to the saw, and is worked by the motion of the lever, G. The two springs, with all their connections, are permanently fastened to the iron plate, D, which is raised or lowered to suit any length of saw by means of the crank, E, and held in position by the thumb screw, O.

This construction enables the saw to run with a peculiar freedom, lightness, and steadiness that is delightful to the mechanical eye, while it insures the accurate performance of the most delicate work. This sawing machine has been introduced into many of the best shops in New York and vicinity, and is, so far as we can learn, giving general satisfaction.

It has also been introduced into nearly every State in the Union, more than two hundred having been sold since last July. The judges at the American Institute Fair reported that, in their opinion, the machine possessed the highest de-



gree of merit, being unsurpassed for convenience in operation and adjustability.

For further particulars address Henry L. Beach, the inventor and manufacturer, office at 90 Fulton street, New York, factory at Montrose, Pa.

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THE RELATIONS OF ART TO INDUSTRY--MUSEUMS OF THE ARTS OF DESIGN.

We are, so far as the mere sheltering and feeding of our bodies are concerned, surrounded by superfluities. We do our utmost to gain more or less of these, according to our personal tastes and desires, and a large portion, indeed the larger portion, of the work of the world consists in producing them. Did we not find in them the reward for our labor in striving after them, we should cease our efforts. These things minister to cravings just as natural as hunger or thirst, if not as potent. The desire for beautiful and ornamental objects exists for a wise purpose, and has chiefly been instrumental in raising a portion of the human race from savage barbarity to refined civilization.

This being true, art is essentially inseparable from industry. Among the workers of the world must be found the artists of the world. Not necessarily painters of pictures or sculptors of marble, but still painters and sculptors as worthy in their way as the devotees of the so called "fine arts." Why *fine* arts? All art is fine, and refining in its tendency, both on its producer and him into whose hands it passes.

There has arisen, in the present age, a revival of the school of stoic philosophers, who decry all sentiment, who say that the romances of the past are of no value to the present, that reason should not only stand pre-eminent to feeling, but that the emotions should be absolutely subjected to reason, and as far as possible crushed out from the human breast. Generous impulse, buoyant hope, noble affection—all these emotions and sentiments are considered by them as weaknesses, obstructive to progress and unworthy the man who wishes to soar above his fellows, either in the pursuit of wealth or fame.

While according pre-eminence to reason over the emotional nature of man, we have not the slightest sympathy with this cold and unhealthy doctrine. A man who is all mind is as abnormally developed as one who is all emotion or all muscle. Sensibilities may be crushed out, but they leave a morbid state behind them.

It is the province of art to develop and discipline the emotional nature of man, to refine it of its grossness, and lead it to expend its force upon high aspirations and things intrinsically worthy. It is not, however, necessary that this refining influence should emanate alone from canvas, from marble, from the poet's pen, from the musician's studio, and the stage. The commonest things of daily use may do their part in this kind of education. Common things may be beautiful, and the tendency of beautiful things is to lead the mind insensibly away from that which is base and unworthy. So much is this the case that it requires an effort of mind to believe that what is beautiful is not also good.

Seeing, then, how art can be made the handmaid of industry, it should be our aim to make every artisan an artist in his avocation. By so doing, we shall not only elevate him but elevate society with him. At present we are doing scarcely anything to promote this desirable end, and it is the principal object of this article to suggest a way in which to secure it.

Much has been said about the desirability of a metropolitan art museum, yet the collection intended to form such a museum will, though admirable and valuable as an educational influence, fall short of what we think should be established for the benefit of mechanics.

The latter should be a museum of the arts of design, and should contain specimens of the finest workmanship in all industrial departments. Dress, furniture, household adornments in short, all sorts of handiwork approved by refined taste, should be seen there. Prizes should be offered for designs, combining highest grace and beauty with widest utility, and exhibitions should be held that would serve to mark progress.

From this would spring up a noble emulation among mechanics, who, finding that honor attached to the skillful in their calling, would earnestly seek to reflect that honor upon themselves. It would add a new attraction to handiwork, and would greatly advance the character of our manufactures. Many things that we are now compelled to import would be produced in equal beauty at home. Every department of industry would feel the manifold benefits of such an institution.

We would not, however, have such an institution only in New York. Every large commercial center should have a similar one, each striving to take the foremost rank, and thus add the stimulus of competition to the interest otherwise attaching to them. So far as we know, no such institution exists, even in embryo, on this continent. Where shall the first one be started?

MAKING ORGANIC SUBSTANCES FROM THEIR INORGANIC ELEMENTS.

We referred, some time ago, to a discovery by Professor Schulze, who succeeded in making a series of organic compounds, hitherto obtained only from the vegetable kingdom or from coal (which is also a product of vegetation in one of the geological eras), directly from the inorganic elements. We will now proceed to describe the details of his discovery and the different steps by which different organic compounds have thus been produced.

He took some form of carbon, say charcoal, plumbago, or graphite, and produced the oxidation of the same without heat (in which case he simply would have had combustion and the formation of carbonic acid). He took permanganate of potash, or the so called mineral chameleon, which is a substance very rich in oxygen and which gives it very easily to other substances with which it readily combines while in the nascent state, that is, while at the moment of being set free it meets another substance with which it can combine. This takes place when one molecule of the permanganate is, under proper circumstances, brought into contact with four atoms of carbon; the reaction is best expressed by the formula $KO+Mn_2O_7+C_4=KO+Mn_2O_4+C_4O_3$. It is seen that the mixture of the two is changed into potash, deutoxide of manganese, and a compound C_4O_3. which Professor Schulze found to be an acid, and called anthraconic acid. After investigation, he found that it was identical with mellitic acid, an acid obtained from the so called honey stone or mellite, which is also, as well as coal and asphaltum, a product of geological vegetation, and, chemically speaking, a mellitate of alumina. This mellitic acid had long since attracted the attention of chemists for reason of being one of the rare organic acids which contain no hydrogen. However, when separated from its base, it takes, like all acids, one atom of HO or water; and its complete formula therefore is C_4O_3HO or HC_4O_4. Succinic acid, obtained from amber, another product of geological vegetation, has the formula $H_3C_4O_4$, and differs from mellitic acid by containing two hydrogen atoms more, but attempts to change one into the other by the addition or withdrawal of these two hydrogen atoms have constantly failed.

The most remarkable property of this mellitic acid is that it withstands the action of the strongest mineral acids; even fuming nitric acid, which destroys almost every other organic acid, is powerless on it, and boiling sulphuric acid dissolves it only without changing it, as it may be again separated by distillation. When treated with caustic soda, however, it produces benzole; by the affinity of caustic soda for carbonic acid, it compels all the oxygen of the mellitic acid to combine with some of its carbon, and to give us carbonic acid according to the formula

$$12NaO+6(HC_4O_4)=12NaOCO_2+C_{12}H_6.$$

The latter $C_{12}H_6$ is the formula for benzole, which being first produced from the resin *benzoes*, was called thus; later, as is well known, it was made from coal tar, and the further operations have been known for some time. The first is to make nitro-benzole by the gradual addition of hot fuming nitric acid; this reaction is explained by the formula

$$C_{12}H_6+NO_5=HO+C_{12}H_5NO_4.$$

The nitro-benzole $C_{12}H_5NO_4$ is then changed into anilin by iron filings and acetic acid, which develop hydrogen which, being in nascent condition, is combined with the nitro-benzole in exchange for four atoms of water driven out:

$$C_{12}H_5NO_4+6H=C_{12}H_7N+4HO.$$

The anilin is $C_{12}H_7N$, and is a colorless oily fluid of pleasant smell, but very poisonous. It is one of the most important compounds in the whole field of organic chemistry, and has taught us many details in regard to the nature of organic bases. As is well known, it gives rise to a large series of beautiful and very intense colors; for instance, the least addition of chloride of lime forms the beautiful aniline violet.

We have thus traced how, in the laboratory of the chemist, without help from any contemporaneous or vegetable growth, a series of products, thus far only obtained by such help, can be made from inorganic plumbago, permanganate of potash, soda, nitric acid, iron, chloride of lime, etc. It is a new contribution to the many triumphs of the chemical laboratory; but we must not forget that they are only the products of organic life which we are thus able to imitate, but not life itself, nor the organic cell, nor even the organic structure which results from cell action. We may make dextrin or starch; but we shall never be able to produce a single starch granule. Who doubts this, let him examine the elaborate structure of the latter under the polarizing microscope.

MECHANICAL IMPOSSIBILITIES.

Much has been said and written upon a certain class of devices, aiming at results rightly deemed impossibilities. These devices, variously styled perpetual motions, self-moving machines, etc., are, however, no more *mechanical* impossibilities than chemical. It is simply impossible for human agency to create a force, by any means whatever, or to increase a force, which would be equivalent to an act of creation. We bipeds that rule over the beasts of the field may, like the inferior animals, act as directors of force, but we create nothing. By our superior intelligence and constructive powers, we may do what animals cannot do, that is, place and link together a chain of causes that lead to a remote and premeditated result. Every machine is such a train of causes, logically connected.

When we speak of mechanical impossibilities, we should limit the term to such results as from their nature must be reached by mechanical agencies, if ever attained at all. Are there any such impossibilities? Is there a result which is accomplished by natural mechanical agencies that cannot be compassed by artificial means? Of course we refer not to any special result, like the revolution of the earth about the sun or the flight of a comet, but to classes of results. Man will never cause a globe like the earth to revolve about the sun, but he can in a smaller way cause a body to imitate this motion. He cannot cause oceans to ebb and flow, but he can mimic the tides. From this point of view, we declare our belief that there are no mechanical impossibilities to mankind. Whatever kind of result is brought about by natural mechanical means may also be done by artificial, at least on a small scale.

We have been gradually led up to this belief through our long observation of the ingenious artificial agencies by which are reached the results of the most complicated manipulations of, that most wonderful of all machines, the human hand, guided by human intelligence. Should any one ask us whether we consider it possible that a landscape should be artistically painted by machinery, we would answer: Behold the Gobelin tapestry, behold the chromo-lithograph; there is your answer. Machinery can fill our halls with music, can do all that is mechanical in the adornment of our houses, can carve our sculpture, can, in short, do everything but think. It is the agent of thought, sometimes of many thoughts, ideas, and conceptions which it works out in all their subtle refinements. Through it, the artist finds the means for the repeated expression and reproduction of form, which his own hand can only work out slowly and with painstaking. Through it, feeble forces are made to assume the direction of large ones, and an apparently slight cause to influence other causes until the resultant effect becomes out of all proportion to the directing effort.

Let it be set down, then, as a maxim established by the mechanical triumphs already achieved, that whatever is accomplished by the action of physical forces in nature, or by the animal mechanism intelligently directed, can be performed by machinery of man's devising. In some cases the work will not be performed as well, but in a large majority of cases it will be done better.

Accepting this maxim as true, what a rich field for inventive talent and constructive skill remains to be worked! What a vast number of operations in daily demand are still performed by slow, laborious, and expensive methods! Take the operation of type setting as a familiar example. Machinery must ultimately do this work and a thousand other things yet chiefly performed by manual labor. We feel assured that the end of mechanical progress is very remote from the present age.

HYDROGEN THE VAPOR OF THE METAL HYDRIUM.

It is now just 30 years ago that the great French chemist Dumas announced, at the termination of one of his lectures on hydrogen, at the Sorbonne, Paris, the following views, then startlingly new and laughed at by many, but now commencing to be appreciated and adopted: "Whatever it may cost me, gentlemen, in the estimation of my colleagues, in giving a new opinion, I ought to express it fully. We ought no longer to consider hydrogen as a metalloid, or as merely approaching to a metal in any form; it ought to be classed by the side of metals or among metals. *It is a gaseous metal, even as mercury is a liquid metal.* If we suppose that it were impossible to liquefy the vapor of mercury, and consider that it is colorless, inodorous, and transparent as hydrogen, we shall have a correct idea of the views I wish to establish By degrees, you will learn to appreciate the correctness of this new theory; when, for instance, you study the different compound bodies of which hydrogen is a counterpart. The *ensemble* of the properties approaches, in fact, to mercury and potassium."

Some German authors have now adopted these views, and Hiller calls, therefore, the element H "hydrium," in order to be consistent with the rule accepted in regard to the metals which have no common names, as cadmium, aluminum, etc. and, according to Dumas' views, hydrogen gas is considered as the vapor of this metal, which, for its condensation into a liquid metal, requires a temperature far below any cold we have thus far been able to produce; and then, for the solidification into the ordinary metallic state, a further degree of cold, perhaps as far below the freezing point of mercury as this is below the melting point of potassium. In order to come to an approximate estimate of such a low temperature, we may consider that hydrogen when cooled contracts like other gases, for every degree $\frac{1}{490}$ of the volume which it possesses at 32° Fah.; and, inversely, increases as much in volume by heating. It has been surmised by many physicists—among them Clerk Maxwell and Clausius—that as heat thus

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increases the elasticity of gases, it is the absolute cause of that elasticity, or, in other words, that the cause of that elasticity is the molecular motion, which we call heat, associated with the molecules of the gas; and which, by their increase, cause more powerful impact on one another and on the walls of the vessels containing them, and so increase the pressure. Therefore, the absolute zero of temperature would be the absolute zero of gaseous tension, that is, the temperature, at which the gas would cease to have any elastic force, would exert no pressure, or have no molecular motion whatsoever. It would then cease to be a gas, as steam ceases to be a vapor when a sufficient amount of latent heat, that is, molecular motion, of the kind described on page 37 of the SCIENTIFIC AMERICAN, is withdrawn. As 1° Fah. added increases the elasticity of hydrogen by $\frac{1}{490}$ of its volume, and each degree withdrawn diminishes the volume by $\frac{1}{490}$, it is evident that, if this law holds at all temperatures, there is no further reduction possible at 490° below 32°, and hence no more heat could be extracted; therefore, the volume of the gas would cease to exist. Hence, if we withdraw heat until we reach —458° Fah., we should arrive at the absolute zero, at which all hydrogen would become lifeless and inert, and incapable of responding to or assimilating any form of motion, which, under other circumstances, would influence its molecules. Other gases would probably liquefy or solidify before that point was reached; but hydrogen, being evidently the most volatile of all, would be the last to lose its gaseous condition, and be compelled to liquefy or solidify; it would then be chemically as inert as two pieces of solid metal, which are mutually inert in regard to one another. In short, chemically speaking, hydrogen would have the property of a solid metal; and, physically speaking, as there is no motion called latent heat of fusion or evaporation, there could be no cause for its liquidity of gaseous condition, and it could be in no other condition than that of a solid. These are the legitimate consequences of the modern theory in regard to heat being a mode of motion.

ANOTHER BIG PATENT JOB BEFORE CONGRESS.

The patent of A. B. Wilson, for the device popularly known as the Wheeler and Wilson sewing machine, was originally granted in 1852, and covers the so-called four motion feed, an important and valuable improvement. The original term of the patent expired in 1856, the owners having, up to that time, realized from it several millions of dollars. The Commissioner of Patents then extended the grant for seven years, for the especial benefit of the inventor; and this last term will expire in 1873, making 21 years in all that the patent has run. But it appears that neither inventor nor manufacturers have yet made from it as much as they think they ought, and so they have applied to Congress for a further extension of the monopoly by special act. All testimony for or against the grant, must be filed, with the Clerk of the Senate Committee on Patents, on or before April 4th, 1872.

We are in general opposed to the grant of special monopolies by Congress, and we think that the industrial interests of the country should no longer be burdened with this particular patent. But it may be said of the owners of the Wheeler and Wilson machine that they have supplied the people with first rate machines, and that although, by their immense profits, they have been raised, individually, from the condition of poor laboring men to be millionaires, they have used their wealth judiciously, to the advantage of the communities where they dwell. It may be further said that it is to the invention of A. B. Wilson and the persevering efforts of the Wheeler and Wilson Company, in developing and introducing the improvement, that we owe much of the present perfection and extended usefulness of the modern sewing machine.

THE Baltimore and Ohio Railroad Company has been experimenting with iron freight cars, and finds them to possess advantages, but have also discovered some disadvantages. They are rendered useless for some kinds of freight on account of the sweating process to which they are subject, and, when ventilation was resorted to to obviate this, it was found that the goods were covered with dust, or were in danger of fire from sparks that found their way in.

NEW BOOKS AND PUBLICATIONS.

POTTERY: Observations on the Materials and Manufacture of Terra Cotta Stone Ware, Fire Brick, Porcelain Earthen Ware, Brick, Majolica and Encaustic Tiles, with Remarks on the Products Exhibited at the International Exhibition, London, 1871. By Arthur Beckwith, C. E. New York: D. Van Nostrand, Publisher, 23 Murray Street, and 27 Warren Street. 1872.

This work will be found of great value to any who are engaged in the manufacture of pottery ties, or anything which is made of clay as a basis. In it the different kinds of ceramic wares are described, together with the processes employed in their manufacture. The employment of clay in the manufacture of building materials also is treated in detail, particular attention being paid to terra cotta, a material not used in this country nearly as much as its merits warrant.

THE PRACTICAL METAL WORKER'S ASSISTANT: Comprising Metallurgic Chemistry, the Arts of Working All Metals and Alloys, Forging of Iron and Steel, Hardening and Tempering, Melting and Mixing, Casting and Founding, Works in Sheet Metal, the Processes Dependent on the Ductility of the Metals, Soldering, and the Most Improved Processes and Tools Employed by Metal Workers. With the Application of the Art of Electro-Metallurgy to Manufacturing Processes, Collected from Original Sources, and from the works of Holtzapffel, Bergeron, Leupold, Plumier, Napier, Scoffern, Clay, Fairbairn, and others. By Oliver Byrne. A New, Revised, and Improved Edition. To which is added an Appendix, containing the Manufacture of Russian Sheet Iron, by John Percy, M.D., F.R.S.; the Manufacture of Malleable Castings and Improvements in Bessemer Steel. By A. A. Fesquet, Chemist and Engineer. With Six Hundred and Nine Engravings, Illustrating Every Branch of the Subject. Philadelphia: Henry Carey Baird, Industrial Publisher, 406 Walnut Street. Price, by Mail, Free of Postage, $7.00.

As will be seen by this very comprehensive title, the original work of Mr. Byrne has received important additions, whereby the treatise is considerably enlarged, and its value much enhanced. The advance made recently in metallurgic science required the revision and additions thus made, which now bring the work fully up to the present state of the iron and steel manufacture, and the arts which employ metals as the whole or part of their materials. The public will receive, with especial satisfaction, the portion of the work devoted to Malleable Casting, Russian Sheet Iron, and American Sheet Iron. The work should not only be in the hands of mechanics generally, but it would be found a most valuable addition to school libraries, for which its comprehensive character specially fits it.

SOPHISMS OF FREE TRADE, and Popular Political Economy Examined. By a Barrister (Sir John Byles, Judge of Common Pleas). First American, from the Ninth English Edition, as published by the Manchester Reciprocity Association. Manchester: John Heywood, 141 and 143 Deansgate. London: Simpkin, Marshall & Co. Philadelphia: Henry Carey Baird, Industrial Publisher, 406 Walnut Street. Price, by mail, free of postage, $0.75.

This is a collection of essays on the fallacy of free trade sophisms, which are commonly expressed in the form of aphorisms. "Buy in the cheapest market;" "Protected manufactures are sickly;" "All commodities should be rendered as cheap as possible," are examples of some of these accepted maxims of free trade, which are here attacked by a legal and logical mind in trenchant, yet thoroughly candid way. The book will be found good reading, both by the advocates and opponents of protection. Its style is elegant, and its arguments are powerful. In short, it is produced by a man who can think, and whose power of expression clothes his thoughts in a most attractive garb.

The DENTAL COSMOS for March maintains its character as a first class professional journal. The subject of replanting teeth, which has interested the profession a good deal of late, receives new light from the experience of G. V. N. Relyea, of Belleville, who states that, in seven cases, four have proved unqualified successes, the three others failing from causes not fully inherent in the operation. Other papers are of interest and importance.

The WORKSHOP, published by E. Steiger, Nos. 22 and 24 Frankfort Street New York, price $4.50 per year, is a monthly publication we have frequently noticed, and which is always worthy of high commendation. Its last issue contains a number of admirable designs for various kinds of ornamentation, furniture, stone carving, silver ware, jewelry, etc.

SCRIBNER'S MONTHLY for April is, we think, the best number yet issued of this justly popular and well conducted magazine. It has a long table of contents, all of which are excellent. The publishers are to be congratulated on the character of the feast they have placed before the general reader in this issue.

The GALAXY for April is a good number. It leads off with a characteristic sketch of Justin McCarthy's, which gives us an insight into the often amusing eccentricities of that brilliant story writer. The French at Home, is another interesting paper, by Albert Rhodes. The Nether Side of New York, by Edward Cropsey, gives us an account of the lottery gamblers. There is, beside, the usual collection of tales, poetry, scientific miscellany, etc.

The AMERICAN WATCHMAKER'S, JEWELER'S AND SILVERSMITH'S JOURNAL is the title of a new monthly publication, issued by Shaw & Co., No. 41 Park Row, New York, price $2.50 per annum, in advance; single copies twenty-five cents. The first number—March—is a good specimen of technical journalism, is neatly printed, and has the appearance of a publication destined to a successful career.

The ATLANTIC MONTHLY for April contains a poem of Longfellow's, entitled the "Ballad of Carmilhan;" another of Parton's sketches, "Jefferson in the House of Burgesses;" the continuation of Hawthorne's "Septimius Felton," and the "Poet at the Breakfast Table," by Holmes, enrich the number. A paper on Immigration, by Edward Jarvis, of heavier and more instructive reading. The "Brewing of Soma" is a short poem by Whittier. There is, beside, the usual complement of tales, notices of current literature, etc. Altogether, the number is an excellent one.

Examples for the Ladies.

Mrs. J. R. Bowen, Wellsboro, Pa., has used her Wheeler & Wilson Machine almost constantly since 1859 on all kinds of material, without any repairs or personal instruction.

Mrs. Mary Hacher, Muscatine, Iowa, has used her Wheeler & Wilson Machine since September, 1857, and earned from $10 to $20 a week, making dresses and cloaks, from the finest to the heaviest, and her machine is now in as good order as when she bought it.

"To Perfume and Dress the Hair, use Burnett's Cocoaine."—*Philadelphia Bulletin.*

Watch No. 2291, Stem Winder—bearing Trade Mark "Fayette Stratton, Marion, N. J."—manufactured by United States Watch Co. (Giles, Wales & Co.), has been carried by me eighteen months; its total variation from mean time, five seconds per month. E. O. WHIPPLE, Con. U. & B. R. R.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

Dry Steam, dries green lumber in 2 days; tobacco, in 3 hours; and is the best House Furnace. H. G. Bulkley, Patentee, Cleveland, Ohio.

Diamonds and Carbon turned and shaped for Philosophical and Mechanical purposes, also Glazier's Diamonds, manufactured and reset by J. Dickinson, 64 Nassau st., New York.

The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin, $4 00 a year. Advertisements 17c. a line.

Right, for Sale, of a valuable improvement in Sad Irons. Address, H. W. Seaman, Millport, N. Y.

Williamson's Road Steamer and Steam Plow, with Rubber Tires. Address D. D. Williamson, 32 Broadway, N. Y., or Box 1809.

Something New. Shaping Machine Attachment for Lathes. Wm. E. Cass, 61 & 63 Hamilton Street, Newark, N. J.

For a well auger, with which a man can earn $50.00 per day, see illustrations on another page.

Lord's improved Screen or Separator for Ores, or any other material. We will send a cut with full explanation. Geo. W. Lord, 232 Arch Street, Philadelphia, Pa.

Wanted—The latest approved Artificial Drier, for fertilizers. Manufacturers, send Circulars. Address Frank Treat, Eastport, Maine.

Dealers in Patents, and Manufacturers of Patented Articles in Iron, address H. W. Thomson, North Williston, Vt.

Where can I get lap welded iron tubes, 4 in. diameter, ¼ in. thick? Address J. Milton Ferguson, St. Louis, Missouri.

Improved Foot Lathes, Hand Planers, etc. Many a reader of this paper has one of them. Selling in all parts of the country, Canada, Europe, etc. Catalogue free. N. H. Baldwin. Laconia, N. H.

To Ascertain where there will be a demand for new Machinery, mechanics, or manufacturers' supplies, see Manufacturing News of United States in Boston Commercial Bulletin. Terms $4.00 a year.

Wanted—A good second hand Steam Engine Cut-off of 75 to 100 Horse Power. Lafayette Paper Mill Co., Lafayette, Ind.

Wanted—A good carriage ironer, with one to $2,000 capital. Business established. Address T. P. Yates, Waverly, N. Y.

Drawings and tracings made of Machinery, Models, etc. C. Delafield, C. E., 26 Broad Street, New York.

Grindstones for Edge Tool Manufacturers. Worthington & Sons, North Amherst, Ohio.

The Baxter Steam Engine is safe, and pays no extra Insurance.

„How to hang and use Grindstones"—a pamphlet sent free by J. E. Mitchell, 310 York Avenue, Philadelphia, Pa.

The most simple and best Pump in use. Hersey's Patent Rotary Pump, for Soap, Oil, Tallow, Beer, Water, etc. We guarantee it the best in use, and allow one month for trial before payment. Send for circular. Hawes & Hersey, South Boston, Mass.

50 Hand Drilling Machines, the best in the market, for sale at half price, $20. Hoffman & Finney, 215 Water Street, Brooklyn, N. Y.

Nickel Plating.—For the best Apparatus and Solutions, apply to George W. Beardslee, 82 Fulton Street, Brooklyn, N. Y.

Wanted—One first class Engine with all modern improvements, either new or second hand, from 150 to 200 Horse Power. Address Box 237, Buffalo, N. Y.

Blake's Belt Studs. The best fastening for Leather or Rubber Belts. 40,000 Manufacturers use them. Greene, Tweed & Co., 18 Park Place, New York

Opium Eaters—If you wish to be cured of the habit, address T. E. Clarke, M. D., Mount Vernon, Ohio.

For the best and cheapest Water Wheel Regulator "in all creation," address Sullivan Machine Co., Claremont, N. H.

Manufacturers and Mill Supplies of all kinds. Greene, Tweed, & Co., 18 Park Place, New York.

Standard Twist Drills, every size, in lots from one drill to 10,000, at ⅓ manufacturer's price. Sample and circular mailed for 25c. Hamilton E. Towle, 176 Broadway, New York.

Steel Measuring Tapes, manufactured by W. H. Paine, 116 Freeman St., Greenpoint, opposite New York City. Send for circular.

The most economical Engine, from 2 to 10 H.P., is the Baxter.

Our Home Physician. By Dr. Beard and other eminent Physicians. Is the latest and best Family Guide. 1067 pages. $5. E. B. Treat, Pub., 805 Broadway, New York. Agents wanted.

$3.00 Microscope sent for $3.00. No toy, but a useful instrument. F. Blockley, 552 Lafayette Ave., Brooklyn, N. Y.

Dealers in Machinery, Metals, and Engineer's Supplies, who have not sent business cards and price-lists to Richard H. Buel, 7 Warren Street, New York, should do so at once.

If you want to know all about the Baxter Engine, address Wm. D. Russell, office of the Baxter Steam Engine Co., 18 Park Row, N. Y.

Magnificent Stereopticon, Phantasmagory, and Mechanical Working Views for sale at a great bargain, 765 Br'dway, 3 flights, from 4 till 6.

If you want a perfect motor, buy the Baxter Steam Engine.

Shive's Patent Watchman's Clock and Time Detector—the best ever made. Price $15. Shive Governor Company, Philadelphia, Pa.

Building Felt (no tar) for outside work and inside, instead of plaster. Felt Carpeting, &c. C. J. Fay, Camden, N. J.

For best Hay and Cotton Press, address C. J. Fay, Camden, N. J.

Save your Boilers and Save Fuel—Use Thomas's Scale Dissolver, pr. 5c. per lb., in bbls. and ½ bbls. N. Spencer Thomas, Elmira, N. Y.

Derricks built by R. H. Allen & Co., New York and Brooklyn.

Farm Implements & Machines. R. H. Allen & Co., New York.

Seeds and Fertilizers. R. H. Allen & Co., New York.

Walrus Leather for Polishing Steel, Brass, and Plated Ware. Greene, Tweed & Co., 18 Park Place, New York.

An Engineer, experienced in designing and constructing Engines, Boilers, and general Machinery, desires a permanent position as superintendent or head draftsman. A practical machinist, familiar with Indicator. Refers to leading concerns. Address M. R., P. O. Box 5,652 N. Y.,

The Greenleaf Grate Bar saves fuel, and lasts much longer than the ordinary bar. Address Greenleaf Machine Works, Indianapolis, Ind.

Peck's Patent Drop Press. Milo Peck & Co., New Haven, Ct.

Enameled and Tinned Hollow-Ware and job work of all kinds. Warranted to give satisfaction, by A. G. Patton, Troy, N. Y.

Best and Cheapest—The Jones Scale Works, Binghamton, N. Y.

Grist Mills, New Patents. Edward Harrison, New Haven, Conn.

Taft's Portable Hot Air Vapor and Shower Bathing Apparatus. Address Portable Bath Co., Sag Harbor, N. Y. Send for Circular.

Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement, Andrew's Patent, inside page.

For Steam Fire Engines, address R. J. Gould, Newark, N. J.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Belting as is Belting—Best Philadelphia Oak Tanned. C. W. Arny, 301 and 303 Cherry Street, Philadelphia, Pa.

Boynton's Lightning Saws. The genuine $500 challenge. Will cut five times as fast as an ax. A 6 foot cross cut and buck saw, $6. E. M. Boynton, 80 Beekman Street, New York, Sole Proprietor.

Presses, Dies & all can tools. Ferracute Mch Wks, Bridgeton, N. J.

For 2 & 4 Horse Engines, address Twiss Bros., New Haven, Ct.

Hydraulic Jacks and Presses, New or Second Hand, Bought and sold, send for circular to E. Lyon, 470 Grand Street, New York.

All kinds of Presses and Dies. Bliss & Williams, successors to Mays & Bliss, 118 to 122 Plymouth St., Brooklyn. Send for Catalogue.

Brown's Coalyard Quarry & Contractors' Apparatus for hoisting and conveying material by iron cable. W. D. Andrews & Bro, 414 Water st., N. Y.

Presses, Dies, and Tinners' Tools. Conor & Mays, late Mays & Bliss, 4 to 8 Water st., opposite Fulton Ferry, Brooklyn, N. Y.

Over 1,000 Tanners, Paper-makers, Contractors, &c., use the Pumps of Heald, Sisco & Co. See advertisement.

In the Wakefield Earth Closet are combined Health, Cleanliness and Comfort. Send to 36 Dey St., New York, for descriptive pamphlet.

For Diamond Turning Tools for Trueing Emery Wheels and Grindstones, address Sullivan Machine Co., Claremont, N. Hamp.

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Notes & Queries.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers.]

1.—FUSIBLE METAL PLUGS.—Can any one inform me what is the mixture of metals for fusible plugs for boilers?—W. H. W.

2.—TESTING HYDRAULIC GAGE.—Please inform me how to construct a hydraulic pump, to test a hydraulic gage.—G. M.

3.—WET COAL DUST.—Will some of your readers tell me whether coal dust burns any better for moistening with water; and if so, give the reason?—G. W. F.

4.—TESTING BARK FOR TANNIN.—Will some expert please inform me how to ascertain the amount of tannin contained in bark and wood? I wish to test certain kinds of timber, both bark and wood, which are said to contain remarkable tanning properties.—J. F. A.

5.—CUPOLA PROCESS FOR IRON.—I have heard that there is a cupola process of melting large bodies of iron; if so, will some one please inform me who the inventor is?—G. S. C.

6.—SEASONING HICKORY.—Is there any way by which one and a half inch square hickory pieces or green wood, in which there is a heart, can be seasoned without checking?—L. W.

7.—FUSIBLE GLASS.—Is there any preparation of glass that will melt at a low temperature and adhere firmly to iron, and what is that preparation? How may the difficulties in enamelling iron be overcome by one unskilled in the working of glass?—J. N. S.

8.—BELTING FOR USE IN LIME WATER.—Can any of your readers inform us of a belting that will stand the continued action of hot lime water?—We wish to use it for elevating purposes.—P. & Co.

9.—SCALES ON IRON AND STEEL.—Can any of your readers inform me how to remove scales from iron or steel that has passed through fire?—J. P. S.

10.—POWER OF WINDMILL.—I am about to build a wind mill of about two or three horse power. I do not know how to calculate or ascertain the power. Can some one give me the number of square feet, of wing surface to wind, per horse power?—J. E.

11.—MERCURIAL COLUMN.—Please inform me the manner in which the mechanical part of a mercurial column is constructed. What I wish to find out is how it is read off, after the pump is applied. I also wish to know if a mercurial gage or column in Boston will agree with one in New York, Utica, Buffalo or Cincinnati.—G. M.

12.—SWOLLEN FEET.—Will some of your many readers tell me how I can prevent my feet from swelling? I have suffered for over two years, and cannot prevent it. It is worst in the morning, for then I cannot put my boots on, and have to wear slippers until noon. My boots are large and well made.—B. S.

13.—NOISE OF STEAM ENGINE.—Can any one inform me of a means of lessening the jar and noise, caused by running a small steam engine, in the other parts of the building in which it is? What would be the effect of putting it upon some elastic foundation? The engine is supposed to be in good working order, and causes no pounding by any lost motion. It is a three horse power, vertical, side attachment to boiler, with which it occupies about three by four feet of floor space.—C. W. W.

14.—A CHEAP POLISH.—I am making brush handles of walnut and cherry wood, and I have to polish them. I have been doing it with alcohol and gum shellac in the lathe, but the price does not justify me in so doing it. Common varnish looks too smeary. Can any one inform me of some kind of a varnish or coating that will not be so costly as polishing, and will have a good gloss? What are saw and chisel handles coated with? They have a nice gloss when first bought.—E. H.

15.—CLEANSING STOVE PIPES.—I have a stove pipe extended from a stove through a large room, say 24 feet long; during the winter, the pipe has become filled up with a thick soft mortar of soot, stopping the passage for smoke, compelling me (with the thermometer at zero) to take down the pipe and dig out the soot. Can any of your scientific readers explain the cause of this and give me a remedy? There is no obstruction in pipes running straight up through the roof. So long as the stove pipe is clear, it gives sufficient heat, thereby dispensing with the use of an additional stove.—N. C.

16.—WORCESTERSHIRE SAUCE.—Can any one furnish me with a good recipe for Worcestershire sauce, or for a good substitute for that condiment?—A.

17.—SUPPLYING STEAM THROUGH LONG PIPES.—Can a four horse power engine be supplied with steam from a boiler, 300 feet distant, and work as well as if the boiler were in the usual proximity to the engine?—J. E.

18.—POWER OF SCREW.—Can any one give me a simple rule to calculate the effective power of a screw of a given diameter and pitch —J. M. T.

19.—STEEL AND IRON.—Will some one tell me a quick and easy way to tell steel from iron? Is there any acid that, if put on a piece of bright steel and a piece of bright iron, will show the difference?—J. H.

20.—INK IN ANCIENT TIMES.—What caused the fading of the old Uncial manuscripts of the Bible? I have been told that they were written with lamp black, and it seems to me that, if lamp black or any compound containing a large per cent of it was used, they would not have faded. In other words, will carbon in this form fade, and what is the true composition of the ink with which these manuscripts were written?—R. P. K.

21.—CHLORO-ACETIC ACID.—Will some of the many readers of your valuable paper furnish a formula for making chloro-acetic acid? —A.

22.—SAW MILLS.—What does E. B. T., of Va., mean by cutting with the grain, and how does he do it? Is anything to be gained by reducing the number of teeth?—F. M. E.

23.—PACKING FOR HIGH TEMPERATURES.—What packing can be used, or how can packing be prepared, so as to be air tight and indestructible, although exposed to a heat of several hundred degrees?—W. C. K.

24.—PURIFYING RANCID BUTTER.—Does any one know where I can get any information in regard to purifying rancid butter? I have examined recipe books and works on chemistry, but can find nothing that is satisfactory.—J. B. B.

25.—QUICK DRYING BLACK PAINT.—How can I make a cheap quick drying black paint, that will preserve a box when buried under ground? Will it add to the durability if painted inside? Will chestnut be best to make the box of?—D. B.

26.—PAINT TO RESIST ACID VAPORS.—Can any one give me a practical recipe for a paint or whitewash that will resist acid vapors? I have tried silicate of soda, but have not succeeded with it.—A. M. P.

27.—IMPERFECT BRASS CASTINGS.—My molders are experiencing considerable trouble in making brass castings. The alloy is composed of nine parts of copper and one part of tin; and the castings come out of the sand apparently all right, but when the scale is removed, they are a perfect honeycomb. Please tell me the cause of and remedy for this.—G. G.

Answers to Correspondents.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at 1·00 a line, under the head of "Business and Personal.

ALL reference to back numbers must be by volume and page.

LIGHT ENGINES OR POWER FOR SAW MILLS.—NEMO, No. 16, January 20th, inquires on this subject, calling for various opinions *pro* and *con*. I propose giving the result of my experience with a circular saw mill of very light power. In 1855, I constructed and put into operation a mill of the following dimensions: Two boilers, each 16 feet long x 20 inches in diameter, with twelve 2½ inch tubes in each, with a small steam drum say 3½ feet long by 18 inches in diameter; engine cylinder 6 inches in diameter x 12 inch stroke; steam pressure 100 to 125 pounds to the square inch. All of the machinery was built by Messrs. Benham & Booth, then of the city of Marysville, Yuba county, Cal. With this power, I ran a 60 inch lower and a 46 inch upper saw, with five inserted teeth in each saw. I erected the mill at Eureka, in Sierra county, about seven miles from the city of Downeville. The average amount of lumber sawed per day (ten hours) was a little more than 4,000 feet, board measure, and that with three men including the fireman. The fuel used was slabs and sawdust exclusively. The timber was mountain hard pine and spruce, with some sugar pine, the mountain spruce being very hard and tough. Much of this timber was from 3 to 4½ feet in diameter. We carried from three eighths to five eighths feed to each revolution of the saw. The mill was a direct attachment, the connecting rod being attached to the end of the saw mandril, which I have claimed as being the first direct attachment circular saw mill ever put into operation in this country. By a series of practical tests that I have made, I find that the average cutting that each tooth in a large circular board saw of ordinary thickness—say 6 or 7 gage—will stand is about one eighth of an inch in soft and one sixteenth in hard timber, varying, between one eighth and one sixteenth, in timber from white pine, poplar, hemlock, etc., to white oak and maple. If, then, a saw of 32 in oak will stand 2 inches of feed to each revolution, 4 teeth will cut one fourth of an inch and with exactly one eighth of the power required to drive it with the 32 teeth, always calculating that the same power is required to keep up the velocity of the saw pulleys, fly wheel (if any), and the belts, and nearly the same friction in a light as in a strong power mill; and this is the same in either a circular or reciprocating saw. Four teeth, cutting the same amount to each tooth, will saw just as smoothly as if 32 teeth were cutting; this I have tested practically. It is not to be presumed that any mill of ten horse power will do one half of the work of twenty horse, on account of the amount of power required to overcome friction and velocity being so nearly the same in each. I am of the opinion and am prepared to show that a continuous motion saw, either circular or band, can be made to perform more work with a given power than can be performed with any reciprocating motion saw. And I question whether any man can produce a reciprocating mill that will equal the performance of my Eureka mill with the same power.—J. E. E., of Pa.

POUNDING OF PISTON.—Answer to query 12, in SCIENTIFIC AMERICAN of February 3d.: Let W. M. T. remove the cylinder head and the piston, and see if his cylinder is counterbored at each end far enough in, so that the piston rings at each end of the stroke will pass out in the counter bore at least one eighth of an inch. More would do no harm if it did not exceed half of the width of first ring. The space at each end of the cylinder on which the piston does not run becomes rough, and the grease gets burned on by the heat of the steam; this, with the wear of the rings on the cylinder, will leave a little shoulder at each end of the stroke, unless the rings pass out in the counterbore. If the keys are driven in the connecting rod, it will either shorten or lengthen the rod so that the piston rings will move a little further at one end of the stroke than they did before; and if so, they will hit this shoulder and make it pound. I have known engines pound in which the rings did not come within three fourths of an inch of the counterbore. I was running one, and when I keyed the box on either end of rod it would pound the rod keyed shorter at each end. I chipped the counterbore in about one inch, and the trouble ceased. If the rings are set out too tight, the engine will pound, and also if the packing around the rod is too hard and tight. The slides may also have a little shoulder worn at the end of the stroke of the cross head, unless the latter should run over at each end. Sometimes the valve will make the engine pound by having too much or too little lead. Let W. M. T. commence with about one sixty-fourth inch lead, and run a day or two, and change to one thirty-second and so on up to a sixteenth or three thirty-seconds inch lead; and where his engine runs the stillest and best keep his lead there. I for one do not believe in too much lead on the valve; but all depends on the speed of piston.—L. B.

SHRINKING OF WOOLENS.—Query No. 17. March 2, 1872.—Good old Saint Clement had tender feet; at one time, he put some wool between the soles of his feet and his sandals, and in a short time he noticed the wool, by the action of the warmth and perspiration of his feet and the act of walking, had grown together, forming a firm pad. That was the first record we have of the shrinking of wool, and Father Clement became the patron saint of the woolen manufacturer. The microscope reveals to us that the fibers of wool are covered with a beard, like some kinds of grass, and heads of grain, which on close contact, and being kept in motion, have a tendency to insinuate themselves into their immediate neighbors, and never recede. When cashmere is taken from the loom, it is a yard and four inches wide; it is then put into a fulling mill, when an insinuating process goes on till the fabric has shrunk to three quarters of a yard in width, not quite that proportion in length, and thus gaining in strength and thickness. All other things being equal, coarse wool, slack twisted yarn, and loosely woven cloth shrink the fastest; consequently, flannels made of fine wool, hard twisted and firmly woven, should be selected; but even those, on being rubbed or agitated in warm soap suds, will shrink.—R. S. B., of —.

TENSILE STRENGTH OF SWEDISH IRON.—I revert to this, not for the last word, but in justice to American manufacturers, to whom you have ever proved a fast friend. On page 107 of your journal, you state: "The breaking weight per square inch of Swedish iron ranges from about 70,000 lbs. to 112,000 lbs., but 85,000 lbs. may be taken as an average." When this was questioned, you give (page 155) Knut Styffe as authority, and refer to pages 124 and 125 of the English edition of his work as giving the tensile strength of puddled steel and puddled iron from Surahammar as averaging 85,000. This is correct, but the strength of Swedish steel was not in consideration, but that of Swedish iron; and, on pages 128 and 129, same edition, Styffe gives the result of these very experiments as showing an average strength of Swedish puddled iron as reaching only 49,229 lbs.; and, on pages 140 and 141, the very highest result reached was of one bar Aryd iron, breaking at 79,667 lbs., while the average of his experiments of iron from puddling furnace and refinery is less than 60,000 lbs. I am sure you will at once see the bearing this claim for Swedish bars has upon the American manufacturer, and upon examination will give corrected statements giving steel and iron separately.—O. W.—O. W.'s references to Knut Styffe's work are correct.

BRONZING GUN BARRELS.—Query 16, March 2, 1872.—First make the barrels smooth and bright with emery; after which clean carefully with lime to remove all grease; then apply the following mixture with a clean sponge or rag: To a quart of soft water, add one ounce and a half of spirits of wine, one ounce and a half tincture of steel, half an ounce of corrosive sublimate, one ounce and a half of sweet spirits of niter, one ounce of blue vitriol, and three quarters of an ounce of nitric acid. The barrels are then to be exposed to the air for twenty-four hours, after which rub with a steel scratch brush until the rust is entirely removed; then again apply the mixture, and in a few hours repeat the scratch brushing. Continue the operation for four or five days; then wash the barrels with plenty of hot water, and while hot, finish with a leather and a little beeswax and turpentine. This will give a fine and glossy finish. Let W. H. R. use the above mixture, or even his own, with these instructions, and he will succeed.—K., of Conn.

PURITY OF WATER.—Query 21, March 2, 1872.—The only water fit for domestic purposes in confined village lots is that saved from showers, in cisterns. These may be very cheaply made in clay soils by digging a hole the shape of an egg, the bottom rounding, about nine feet deep by eight feet across. Four feet from the top, cut a shoulder in the clay wide enough to hold a brick, and lay an arch all round in common mortar, leaning each tier forward, till at twenty inches from the top the hole is not more than two feet in diameter. Fill over the arch with earth as you proceed. Plaster well all over the clay surface with a mortar made of one part hydraulic cement to three parts of sand. Mix a small quantity at a time and apply two or three coats. The last is best. Finish with a wash of pure cement put on with a brush. This cistern may be made by a common laborer for about $30. One I had made in 1854 is in perfect order yet, and has never given any trouble. Heaven's water is the best, purest, and healthiest in the world. Keep the roof clean and no filter is ever needed. A chain pump is best as it agitates and aerates the water. Here in the West we use no other sort.—B, T., of —.

THE SLIDE VALVE STEAM ENGINE.—Your correspondent is correct in saying that most of the western engineers persist in maintaining that the pressure of steam only covers the area of the ports, not the whole of the valve. A large majority take this position, though it is certainly an erroneous one. The slide valve engine is necessarily very imperfect, not only on this account, but from the fact that, while the crank is on its center and the engine is thus in its weakest position, the pressure of steam is greatest, there being very little counteracting pressure in the cylinder. Yet, imperfect as it is, it is the only engine now used by all the railways of the world. Theoretically, I believe it only utilizes about four per cent or one twenty-fifth part of the steam power which ought to be produced by the combustion of the coal. Actually and practically, in his pamphlet published in 1870, on the awards made by the American Institute of New York, Mr. Harris, of Providence, R. I., represents it as being fully fifty per cent behind the performance of a Corliss engine, the cylinders of each being of exactly the same size, and careful notes being made of the coal consumed and work done.—B. T., of —.

B. T., of —.—The coefficient of friction between two surfaces is the constant pressure or force it takes to move one upon the other, usually expressed as a percentage of the pressure in pounds. This in estimating friction is multiplied by the pressure, and not by the extent of surface. Thus, should two plates of cast iron of equal weights, but with widely different areas of bearing surface, be compared, resting upon bearing surfaces of the same material, they would be found to have the same coefficient of friction, the pressures being their weights only. If a pressure equal to their weight be added, the coefficient of friction should be multiplied by twice the original pressure, and so on; and to find the power expended in overcoming it, the product is multiplied by the distance the friction is overcome per minute, and the resulting product divided by 33,000, which gives the total in horse power. From this and suitable tables of coefficients of friction, to be found in almost any handbook of engineering, you may solve the problem stated for yourself.

TANNING RABBIT SKINS, ETC.—Query 4, March 9, 1872.—Let L. H. S. stretch the skin tightly upon a board, and scrape with a dull knife until all the flesh is removed. Mix two quarts of milk, one teacupful of salt, and half an ounce of oil of vitriol. Warm this mixture to somewhat more than blood heat, but not to the scalding point, and soak the skin in it forty minutes, stirring and squeezing it in the warm liquid. Press out the liquid and let the skin dry a short time, then commence rubbing the flesh side with all your strength across the smooth edge of a board until the desired softness is obtained.—B. F. F., of Pa.

SOLDERING STEAM PIPES.—Query 4, March 2, 1872.—E. W. K. can use soft solder to stop cracks or splits in wrought iron steam pipe, by first chipping the split out, lengthwise and nearly through the pipe, with a diamond pointed chisel, then cleaning the surface of the pipe on both sides of the split with a file, and then burring the edges with a light hammer, taking care not to get any dirt or grease in it while hammering. It can then be soldered by first wetting the clean part with chloride of zinc to which is added a little water and sal ammoniac. Burring the edges of the split prevents the solder from being thrown out at a high pressure, if the pressure of steam does not exceed 140 pounds, the temperature of which would be sufficient to melt the solder. I have tried this and know it to be effectual.—W. S. B., of Ill.

TRANSFERRING PRINTS.—No. 17, page 169.—K. W. is hereby informed that my workmen have tried everything recommended for this purpose, and find good No. 1 furniture varnish, reduced with an equal quantity of turpentine, to give the best satisfaction for all purposes of transferring. But on glass, where total absence of color is required, I would use fir balsam, dammar varnish, two parts each, and Venice turpentine, one part, reduced with turpentine two to one.—C. T., of Vt.

TRUEING GRINDSTONES.—To A. J. P. S., query 2, March 2, 1872. A piece of half inch gas pipe, about two or three feet long, with a screw cut on half its length, is used for trueing grindstones by turning the pipe around. The threads of the screw form cutting edges as the pipe wears away, and the thinness of the metal prevents it from heating.—J. E. M., of Pa.

TANNING RABBIT SKINS.—To L. H. S., query 4, page 169. If newly taken off, all right; if dry, soften in water. Equal quantities of fine salt and pulverized alum strewn upon the flesh side of the skin; double it together, flesh and flesh; roll it up tight; let it lay three or four days, turning it over twice every day; shake remaining salt and alum off; when nearly dry, in the shade, rub the skin briskly, on the flesh side, over the edge of a hoe, spade, or shovel. Do this thoroughly, and when the skin is dry, stretch it with the hands until soft, which will be in a few minutes. The salt and alum should be put on as thickly as if it were salt only, intended to save the skin. Sheep skins may be done in the same way.—N. D., of —.

SPLITTING OF HORSE'S HOOFS.—If E. E. S., query 18, Feb. 24, will rasp his horse's hoofs perfectly smooth all around up to the soft part next the hair, sandpaper them with coarse sandpaper, then beat up a hard lump of charcoal, and mix up with train oil to the consistency of paste, and rub into the hoof well with a woolen cloth once a day, he will very soon find a change in the hoofs. For cracks, rasp, with the corners of the rasp, across at the top of the crack, as deep as it will bear, put on thin broad shoes, and all will work right.—J. L. B., of Tenn.

PRESSURE GAGE QUESTION.—A. H. G., of Mo.—According to Marriotte's law of gases and vapors, steam pressure is "inversely as the space occupied." Then why is it that, in blowing off in boilers, the steam gage does not fall as the water lowers in the boiler, but remains at the same point until the water is all out?—A. H. G., of Mo.—Answer: It is because the accumulated heat in the boiler and contained water generate steam as fast as the water escapes, thus keeping up the pressure.

COINS.—No. 3, page 169.—L. B. will find that oxalic acid, dissolved in water, is the best article to cleanse old coins. It is also the best for cleaning old brass, either household utensils or the tarnished brass work of locomotives. And oxide of tin is the best article to finish or polish brass, etc., with, after it has been well cleaned.—C. T., of Vt.

WATER FOR AQUARIA.—No. 13, page 169.—I would inform C. D. that the only effectual way to keep pure water in an aquarium is to keep a small stream running in at the bottom and another running out at the top. But he can fit a bent tube to his aquarium, and let the top end of the tube be higher than the water in the aquarium, and fit a funnel to the top end of the tube to receive the water from a pump or dipper, as may be most convenient.—C. T., of Vt.

TEST FOR NITRIC ACID.—To P. C. H., No. 19, page 169.—Add to your suspected liquid a drop more of sulphate of indigo, and boil; the nitric acid should decolorize the solution. At other times, a crystal of protosulphate of iron, on being added, should present a reddish color. Litmus paper is of no use, as any acid would have the same effect.—E. H. H., of Mass.

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TEST FOR LEAD IN WATER.—To F. C., No. 24, page 169.—Acidulate the gill of concentrated water with nitric acid, and add a drop or more of a solution of bichromate or iodide of potassium; either will produce a yellow precipitate; sulphuretted hydrogen will produce a black cloudiness. The last two are very delicate tests.—E. H. H., of Mass.

RENEWING THE COLOR OF FADED BLACK WALNUT DOORS.—If F. C. (No. 23, page 169), will go to any color shop and get one pound of burnt umber, ground in oil, and add a little of it to his oil when he oils over his doors, he can highten the color to any point required. But, to do a good job, he must first scrape off all oil, varnish, and shellac, and apply the color to the bare wood, rubbing it into the grain, and then shellac and varnish anew.—C. T., of Vt.

DYEING FURS.—No. 1, page 169.—L. K. is informed that a solution of nitrate of silver is the best dye for furs. It may be applied and rubbed in with a sponge or brush, and the furs should then be exposed to the light.—C. T., of Vt.

CEMENT FOR ALABASTER.—Query No. 7, page 90.—With white of egg, beaten to a froth, mix dry white lead to about the thickness of ordinary paint and apply quickly, as it dries very fast.—H. H. C.

CEMENT FOR IRON PIPES.—E. W. K. can stop leaks in steam or water pipes, if the cracks are lengthwise, by a clamp or clamps made of thin strips of iron, bent to fit the pipe two thirds around it, with the ends turned out to admit a bolt through them which can be screwed up until neither steam nor water will escape.—J. H. G., of Tenn.

SPEED OF CIRCULAR SAW.—On page 138, current volume, N. B., of Pa., states that it will be safe to run a 52 inch circular saw 1,500 revolutions per minute. Now I and many others have supposed it was excee ingly dangerous to run at so high a rate, owing to the liability of the saw to burst when going at such a speed. I think it highly important for the public to know if N. B. is correct, differing as he does so widely from the commonly received opinion.—C. B., of Minn.

FREAK OF PRESSURE GAGE.—In reply to Mc., query 21, page 138, "Freak of a pressure gage," I will say that my pressure gage always was this. Most pressure gages are filled with water, and water will expand in freezing. It will sometimes make a gage go up to 150. This has always been my solution of the question.—H. B., of Pa.

DYEING FURS BLACK.—To K., query 1, page 169.—Steep furs for half an hour in a bath, of one part bichromate of potash in eighty parts of water, as hot as the skins will allow. Take out, drain, and rinse in clean water; then steep and work, in a bath of logwood, one half the weight of the furs, in a sufficiency of water (not as before) for another half hour. Take out and expose to the air, and afterwards wash well in clean water. Of course the furs must be free from grease.—E. H. H., of Mass.

NON-INFLAMMABLE SAWDUST.—To L. M., No. 9, page 169.—Steep sawdust in a saturated solution of alum, and dry.—E. H. H., o Mass.

PREVENTION OF FREEZING OF VINEGAR.—To J. R. D., No. 15, page 169. The addition of one eighth part of glycerin will prevent trouble; but may not be applicable, on account of its sweetness.—E. H. H., of Mass.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

PANELING MACHINE.—Silas Heyser, of Jackson, Mich., assignor to James Harding and James B. Wesley, of same place.—A suitable rectangular frame is used with an ordinary table on the top, on which is arranged a broad vertical guide, made adjustable laterally by means of the slotted bars and clamping screws. Said guide, also, has a notch in the lower edge near the center, through which the rotary planing tool works against the board to be acted on, which is fed along the side of the guide in any suitable way, and held up snugly against it by a spring. A short adjustable guide is placed in front of the first named guide, behind the cutting point, between which and the first the board passes as it is dressed. This cutter is mounted on the upper end of a vertical mandrel running in fixed bearings, and acts upon one side of the board, while another similar cutter mounted on a similar mandrel, adjustable toward or from the mandrel works on the other side. The said cutters are suitably shaped for making the wide rabbets at the edges of the boards, such as is common in paneled boards. Sheet metal or other hoods are placed over the cutters and provided with extensions leading to one end of the frame parallel with the guide and arranged to conduct the chips off the table, the said chips being forced by the blast nduced by the rotation of the cutters. These hoods have openings at the sides suited for the cutters to work through to reach the boards to be dressed. These hoods constructed as described, when combined with paneling tools placed in one end thereof, and operating to cut out the shavings and to produce a current of air which forces them through the hoods, constitute the invention.

LAMP.—William Brown, of Newburyport, Mass.—The peculiarity of this lamp is that by a series of gauze screens, and a filtering stratum of sand or other equivalent material in connection with a self acting spring valve, all danger of flame entering the oil reservoir is obviated under any and all circumstances. In case of a fall of a lamp, no oil can escape, and all that could possibly burn is that held by the wick and the small supply tube that leads to it. Thus it is claimed all danger of explosion, or extensive conflagrationis obviated. The reservoir may be placed at any required distance from the lamp, in railway cars, etc., and the device is equally applicable to chandeliers, brackets and lamps with standards.

CHIGNON.—Edward Ulmann, of New York city.—This invention has for its object to reduce the expense of imitation braids, waterfalls, or chignons, by doing away with the necessity of braiding the same. It consists in a chignon, as a new article of manufacture, produced by subjecting it to pressure and heat in such manner that the desired form and appearance is produced without braiding or twisting the hair or imitation hair by hand. At present such articles, whether produced from hair or other fiber, are braided to imitate natural braids. The process of so doing is tedious and costly, and requires a considerable additional quantity of material that cannot be exposed to view on account of the peculiar formation of the braids. This imitation chignon is provided with imitation braids, produced by pressure between appropriate shaped dies, which are heated to impart gloss, and to cause the fibers to retain the shape imparted to them. In this manner, it is claimed, an article equally as valuable as, but far less expensive than, the braided chignons is obtained.

CAR COUPLING.—Aaron K. Kline, of Readington, N. J.—A double headed coupling rod is employed. The draw heads have wide large mouthed openings for the coupling bolt, the sides and bottom of which converge toward the rear to a point behind which are square shoulders for holding the head of the coupling rod which drops behind them, a narrow space being provided between that portion of the side wall rising higher than the bottom wall for the shank of the connecting bolt to fall into. The side walls are brought so close together in advance of this space as to cause the rod head to rise without the aid of the bottom to pass over the shoulders to the space. In this space the shoulders are recessed where the head draws against them so that, when the link is uncoupled at one end and let fall, the other head will be arrested by the upper wall of said recess so as to prevent the coupling link from falling out. There is an overhanging projection on the end wall of the recess, under which a projection on the head of the rod is engaged, when it is adjusted for coupling. A coupling rod, with a head on one end and a link on the other, may be used for coupling a draw head of this kind with one of the other kind.

CONSTRUCTION OF RAFTS.—John T. Moore, of Havre de Grace, and Ravand K. Hawley, of Baltimore, Md.—As ordinarily or heretofore constructed, rafts have not been able to withstand the severe strain incident to transit across the larger lakes or ocean bays during rough weather; and the object of this invention is to so connect the logs of the ordinary length with a skeleton of booms as to enable the raft thus formed to be towed in heavy waves or seas with perfect security. To this end are employed screw eye bolts to secure the logs to the chains which connect the parallel booms, so that they may play thereon or have the free movement necessary to allow the raft, as a whole, to rise and fall or otherwise conform to the motion of the waves. The screw bolts are likewise easily inserted or removed, do not, it is claimed, materially injure the lumber, are strong and durable, and have little friction on the chains or ropes. A new chain hitch or mode of fastening the booms or logs together is used, whereby greater security is obtained without a complicated arrangement or tedious process of manipulating to adjust the same.

STOPPER FOR BOTTLES, BARRELS, ETC.—Alfred Marsh, of Detroit, Mich. assignor to Annie Marsh, of same place.—This is a barrel bung made of wood or other suitable fibrous material, which will expand and contract to keep the bunghole properly closed. A metal plate is placed on the top of the bung and is provided with a shank, which extends through the bung and is, below the same, fastened with a pin or wedge, a metal washer being placed against the under side of the bung, so that the wedge bears against it. The bung is thus confined between the plate and washer, and thereby considerably strengthened. In the center the upper plate is perforated, the aperture extending into the upper part of the shank to form a cavity therein. This cavity is narrow at or near the top, and enlarged below. A key, having projecting lugs or ears, can be fitted through the narrow part of the cavity into the larger portion of the same, and then turned so that its ears will come under the shoulders. By then pulling the key directly, or with the aid of a lever, the bung can be readily extracted. The same invention can be applied to bottle stoppers.

LOG LIFTER.—Green B. Sims, of Elizabeth, Ind.—This invention has for its object to furnish an improved machine for lifting logs and other heavy weights to load them upon wagons, for pulling stumps, and for other similar purposes. It is an arrangement of lever and ratchet, in principle somewhat like a lifting jack for greasing wagons, pivoted at the bottom so that it may be inclined from the perpendicular to accommodate itself to the motion of a log of which one end is raised while the other rests upon the ground. It is provided with an apparatus for grappling the log or other object to be raised, and being portable may be used with convenience for handling various materials in moving them for transportation and in warehouses.

COTTON PRESS.—Robert N. Wyatt, of Tehula, Miss.—The press is revolved upon improved bearings by power applied through levers. A right and a left hand threaded screw revolve with the press. They pass through the sill and girder of the press and engage with screw nuts which are bedded in the sill and girder. On the inner end of each of these screws is a follower, which, as the press is revolved, approach each other and press the cotton or other substance between them, or recede from each other by reversing the motion. The end frame s are constructed together by rods, and the frames are connected with friction caps by means of the gains in the lugs of those caps. The bed nuts and friction caps are grooved and ribbed, so that, as the press revolves there can be no lateral motion, and so that the screw will always be kept in a central position and not be subjected to undue strain or danger of fracture at these points. By thus improving the frictional points, it is claimed, the revolving press is made strong and durable, and is not liable to break or get out of order; besides the improvements render these parts of the press much more simple and inexpensive than they have heretofore been.

GATE FOR WATER WHEELS.—Edward F. Hunt, of Cornton, Vt.—This invention consists in the application to the stationary wheel case of swivel guides, in which the gates can slide when moved by the turning of the ring to which they are pivoted. By this means water may be admitted from either direction, so that the gates are equally adapted to right and left handed wheels.

CASH FARE BOX.—James W. Prendergast, of New York city.—This box is designed to be supported on the arm or in the hand of the conductor, and to be carried from passenger to passenger throughout the car. It is also intended that each passenger shall deposit his or her own fare, and that the conductor, while he is enabled to make the change, is not allowed to handle the fare. A hood, into which the passengers drop their fares, is placed upon the top or near the top of the box. The fare drops from the hood on to a slide, from which it slides on an inclined surface and thence along an apron to a revolving plate, where it is stopped. A plate of glass forms the upper part of the front of the box. Two sides of this part of the box are also of glass. While the fare rests on the plate, it is exposed to the view of both passengers and conductor. When the conductor sees that the proper or required fare has been deposited by the passenger, he turns the plate and drops the fare into the cash receptacle or bottom portion of the box. This part is closed and locked at the office before the box is given to the conductor, and is kept locked or locked and sealed until the box is returned to the office for making the returns. In one corner or in some other part of this cash receptacle, or in some other part of the box, is placed a small vial or tube filled, or partially filled, with shot. This tube is open at the top, so that if the fare box is inverted the shot will escape from the tube by their own gravity. Now, the box would never be inverted or turned over except in an attempt to tamper with it for gaining access to the cash by allowing the latter to slide from the box. The revolving plate is held in a horizontal position by means of a double spring. The shaft or pivots of this plate project through the sides of the box, with a knob on one end for turning the plate through the use of suitable mechanism. A fare box provided with a shot tube for the purpose set forth, constitutes the claim upon which a patent has been issued.

SELF LOCKING BLIND BUTT.—William R. Goodrich, of Utica, N. Y.—This invention has for its object to furnish an improved reversible locking hinge for blinds and shutters. It consists in making double locking inclines on the male or pintle portion of the hinge. By this construction, when the blind is swung fully open, it is locked. The butt can be used as a right or left butt, as may be desired.

COMB SAWING MACHINE.—William Booth, of College Point, N. Y.—In the ordinary comb sawing machine, the shift screw thread is cut upon a cam so that, when the descent of the platform is limited by the stop rod, the platform will be held up from the cam for a part of its revolution, leaving a portion of its attachments free to slip. This difficulty is, it is claimed, wholly removed by the present invention, which, by connecting the shift with the frame, always holds the frame and its attachments securely against slipping or lateral movement, except when moved by the shifting device. A circular shift wheel, constructed in a peculiar manner, in combination with the driving shaft and stationary screw, attached to the frame that carries the pivoted platform, clamp holder, and comb clamp, and a combination of the clamp holder, clamp, clamping screw, and swivelled adjusting screw with each other, said parts being constructed and operating together in a peculiar manner, constitute the claims upon which a patent has been obtained.

PEG CUTTER.—Jacob G. Klock, Mansfield, O.—The invention relates to a new mode of cutting or rasping out the pegs that project from the inside of boots or shoes. The means consist of an arc shaped float, which is worked by a treadle, and is moved in arc slots of a hollow upright. It seems to be not only theoretically correct in its construction, but to work with such accuracy and efficiency that no shoemaker should be without the device.

CAR COUPLING.—Henry Hawley, of Lynchburg, Va.—The coupler is connected with the draw head in any convenient manner. The coupling link may be formed in any manner with spear heads at the ends. Springs are attached to the opening plates, and an opening button is attached to an upright shaft. This shaft passes through the coupling and is supported by the the bottom plates thereof and by the top plate. A cord pulley on the top of the coupling is fast on the shaft. To a pulley on another vertical shaft a cord or chain is attached. Its other end passes around the first named pulley on the top of the coupling and is attached thereto. When the latter pulley is turned, the ends of the button are turned in contact with the opening plates, which throws the springs with the catch plates from the shoulders of the spear heads, and thus uncouples the cars. The cars are self coupling as they come together, as the link requires no hand manipulation. A cord may extend from cranks under the coupling to the locomotive, so that the engineer may at any time release the locomotive from the cars.

CORPSE PRESERVER.—John F. Waters and Edward G. Waters, of Philadelphia, Pa.—The object of this invention is to provide suitable, convenient, and effective means for preserving the corpses of deceased persons during the time which elapses between the first stages of decomposition and burial. It consists in a wood case with a perforated lining and with a space between the outer case and the lining, and otherwise so constructed that the corpse may be exposed to any disinfecting agent that may be employed. A false bottom is perforated beneath the lining, thus making the middle portion of the bottom double, and having a discharge aperture. This portion is fitted to a bottom or base, having one or more drawers therein, arranged at the ends or any portion thereof for containing any disinfecting material or substance, either such as are now known or may hereafter be discovered. The gases evolved from such disinfecting material will pass into and fill the interior from the space at the sides and ends, and through the space beneath. Any fluids which may escape from the corpse will pass into the space beneath the double bottom, and may be drawn from the base by a spigot. There are test holes through the top of the case by means of which the first indications of decomposition may be detected, and which is immediately arrested by the application of the disinfectant agents. These holes are closed by slides. A glass is set in the top, through which the face of the corpse is visible. The top closes air tight on to the case, and the case is designed to close air tight on to the bottom. The case is held tightly down to the bottom by clutches and keys, four in number, more or less.

LIFTING JACK.—Beers B. Tomlinson, of Mt. Carrol, Ill.—This is a new wagon jack of very simple and convenient make, applicable to axles of suitable hight. The invention consists in a new arrangement of standard shifting lever and locking link, by which the lever can be shifted for the front or hind axle without requiring the displacement of the pivot, while yet the latter is also adjustable in the standard, to provide for still greater differences of hight than the lever alone can regulate. The entire jack can be made of cheap and light material, but with great strength, all parts being used to advantage.

SEWING MACHINE FOR LEATHER.—George V. Sheffield, of New York city, assignor to himself and Godfrey K. Mellor, of Woonsocket, R. I.—This invention is an improvement in the class of sewing machines designed especially for sewing leather or other thick and tough material. It consists mainly in the employment of a "whirl" or thread carrying plate and a reciprocating rotating needle, whose conjoint operation produces the desired loops and twists in the thread. The mechanism is very ingenious and seemingly well adapted to secure a good result. In order to secure a still firmer hold, the inventor proposes to use thread of successive double conical sections, or swells, they being so spaced that the needle will always take hold at the thin portions, and thereby draw two conical pieces alongside of each other up, such pieces entering the leather like wedges, and holding it very securely. This last is a novel and striking feature. Patents have also been secured abroad.

SAFETY GUARD FOR HATCHWAYS.—Zebedee S. B. Weeks and Charles L. Kohler, New York city.—This excellent invention consists of a safety guard for hatchways so arranged and connected with the hatch door or doors that it will be automatically closed when the door opens, to guard against falling through, and to be similarly opened when the door closes, the said guard being hinged to its support and connected to the door by a guard or chain which works over guide rollers in such manner as to allow of the automatic opening and closing. The guard may consist of a framing of bars, jointed together in any suitable or approved way, and pivoted to the post placed in front of the hatchway, so as to swing up and down, the joints allowing the guards to be pivoted to the posts in two or more places; or it may consist of a parallel or rigidly constructed door or gate, and be hinged to the post at one point only. Each section of the guard is connected to its corresponding section of the hatch door by a cord, which works over guide rollers in such manner that when one rises the other will fall, and *vice versa*, so that, whenever the hatch door is opened, the guard will fall in front of the open hatch and guard it while open. The guard may, however, be opened while the door is opened, if required, by lifting it up. This simple contrivance will insure the closing of the guard at all times, when necessary, and thus save lives and injuries to persons liable to accidentally fall through when the guards, which have to be worked by hand, are neglected.

BROILER.—Richard Penn Smith, New York city.—This invention consists of a broiler constructed wholly or in part of fine wire gauze, or finely perforated metal or other substance, to allow the heat to act upon the meat and yet prevent the actual contact of the flame with the meat, whereby the inventor claims to utilize all the advantages of the heat for broiling without any of the destructive effects of flame and smoke, the instrument being so constructed as not to partake of the nature of a frying pan. In order to prevent the actual contact of fire and smoke with the meat, which are injurious to it in respect to taste and smell, he proposes to interpose between the fire and the meat, in some form or other, fine wire gauze or finely perforated sheet or cast metal, adapted to arrest the passage of flame, on the principle of the Davy lamp, while allowing the heat to pass; and for this purpose he may take an ordinary broiler and attach a sheet of wire gauze below the bars, or may use a wire gauze or perforated sheet only, the same being provided with suitable legs and a handle and strengthening bars or strips of any kind at the edges; but he prefers to arrange the said gauze or perforated sheet in corrugated form, with end and side pieces of any kind for making strong and rigid broilers. And for preserving the gravy, he proposes not to perforate the plate at the bottom of the grooves or corrugations, or, in the case of wire gauze being used, to fit a little angle plate of sheet metal in the bottom of each groove, arranging the surface flush with the surface of the gauze; and at one end, preferably the front, he arranges a trough or reservoir for these troughs to empty into. A handle and legs, attached to the rear end to elevate it a little, and arranged so they will fold up with the body of the broiler, for convenience in packing, complete the device.

GRAIN SEPARATOR.—James C. Bowden, Farmington, Cal.—This grain cleaner and separator is claimed to be thorough in operation, easy to keep the motion, and always under full control of the operator, who can regulate the quantity to be fed with great exactness. Zinc screens combined with sieves, plates, and rotary screens, arranged in a peculiar way, and an arrangement, in a grain separator, of a shaft carrying wheels, belt, and pinions, with respect to the several screens and sieves, for the purpose specified, are the claims upon which a patent has issued.

INDICATOR PADLOCK.—Frederick J. Hoyt, New York city.—This invention consists of an ingenious combination, with a lock, of a rolled and numbered paper strip, and apparatus for causing said strip to be forced out of the case the distance of one number by the key each time it is turned, in order that the person locking the lock may tear off the number thrust out to be kept for comparison with the numbers torn off by others, to show whether the lock has been unlocked by any unauthorized person. The essential object of the improvement is to provide a lock for freight cars, by which to ascertain, with unerring certainty, on what section of a long line of road missing goods have been stolen, in order to render the particular section whereon the goods were lost accountable, instead of charging the loss *pro rata* upon all the sections, as is now the practice, owing to the want of any reliable means to fix with certainty upon the section encountering the loss. The inventor does not limit himself to any particular arrangement of the apparatus for actuating the paper strip, nor to actuating the apparatus through the medium of the key post, for it may be done by the tumblers, or by the bolt, or any moving part, the same being provided with a pawl to actuate the rollers, or other equivalent means. This numbered paper strip will, it is claimed, not only indicate with unerring certainty between what stations—where the lock is opened and locked by duly authorized agents—it has been opened unauthorizedly, but it will be a check upon the station agents, whose duty it is to open and relock them, by requiring each station agent to forward the number torn off by him to the general agent for comparison; for, if one agent neglects his duty, the number torn off by the next one, which the first should have taken, being compared with the first number torn off at starting, will show the neglect of the delinquent agent.

BEATER PRESS.—Franklin Frey, Liberty, Ill.—This invention consists of a beater press, wherein the beater is raised by a capstan pulley, and a loose arm carried by said pulley and held so as to be let free by a tripping apparatus at the proper time to let the beater fall. The beater is forced down to press the bale, after it has been beaten in this way as much as required, by levers worked by another drum on the capstan, which is disconnected from the shaft, so as not to turn when the beater is to be worked.

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DISH DRAINER.—Henry R. Richmond, of New Plymouth, New Zealand.—This invention consists in a dish drainer consisting of a rack, inclined board, sloping gutters, and shelf, designed to be attached to the wall of the kitchen or other washroom, and preferably above the table upon which the crockery is to be washed, so that it may be conveniently accessible.

CLASP FOR LOOPING SKIRTS.—Marion R. Zerbe, New York city.—This invention consists of a skirt clasp for looping up dress skirts and the like, which is formed of a small plate of metal with a spring, button, and points on each side, so arranged that it will be buttoned to a slight loop or fold of the skirt by one end, and suspended to receive the other fold in the other end, the said folds being secured by turning the buttons over the fold, which is placed on the plate and the points. The instrument is to be made quite small and light, and may be made of any fine metal and in any ornamental style.

COTTON PRESS.—Malikiah W. Bradford, Greenwood, La.—This invention has for its object to furnish an improved press for pressing and baling cotton and other materials, which shall act with increased power as the bale becomes more and more compressed. An arrangement of hinged sides, detachable ends, lock bars, and forked or slotted bars with respect to each other, and the box, frame, and top frame to which the head is attached, and also an arrangement of the top frame with its hinges and hasps, in connection with a head block, frame and receiving box, composed of sides and ends in a peculiar manner, are the claims on which a patent was granted. The press is of the class in which the power is applied through the agency of ropes or chains, and a windlass or drum in connection with toggle jointed levers.

BREECH LOADING FIRE ARM.—Ruth Goshen, New York city.—This invention has for its object to improve the construction of breech loading fire-arms, so that ordinary muzzle loaders may be easily and cheaply converted into breech loaders, and which improvement may be applied to new arms with facility and advantage. The improvement is covered by four claims on which a patent has issued. Our readers have been introduced to this inventor before. On page 103, Vol. XXIV, we published an article entitled "THE LARGEST INVENTOR YET," giving his birth and parentage, and a brief sketch of his personal history and appearance. He is decidedly the largest client we have ever had or ever expect to have.

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19,637.—GRAIN SEPARATOR AND SCOURER.—S. Howes, Silver Creek, G. E. Throop, Syracuse, N. Y.
19,594.—ENGINE VALVE.—I. Van Doren, Annandale, N. J.
19,855.—SPLICE FOR RAILS.—J. H. Norris, E. W. Scudder, Trenton, N. J.
19,548.—TIGHTENING KEYS OF JOURNAL BOXES, ETC.—L. Dederick, Jerse City, N. J.
19,610.—RAISING DOUGH.—J. Perry, Brooklyn, N. Y., and J. C. Fuller Orange, N. J.

DISCLAIMER.

STRAW CUTTER.—D. T. Willson, D. Fleming, C. H. Willson, executors of T. H. Willson, deceased. Letters Patent No. 19,462, dated February 23, 1858.

DESIGNS PATENTED.

5,658 to 5,660.—CARPETS.—R. R. Campbell, Lowell, Mass.
5,661 to 5,664.—CARPETS.—J. M. Christie, Lowell, Mass.
5,665 to 5,669.—CARPETS.—J. Fisher, Enfield, Conn.
5,670 to 5,676.—CARPETS.—O. Heinigke, New York city.
5,677 to 5,679.—CARPETS.—H. Horan, Newark, N. J.
5,680 to 5,684.—CARPETS.—L. G. Malkin, New York city.
5,685 to 5,693.—CARPETS.—E. J. Ney, New York city.
5,694.—PAPER CLIP.—J. Ottner, New Britain, Conn.
5,695.—PUMP.—W. Burlingham, New York city.
5,696.—SASH FASTENER.—O. E. Fogelstrand, Kensington, Conn.
5,697.—CHEST HANDLE.—O. F. Fogelstrand, Kensington, Conn.
5,698.—CUPBOARD CATCH.—O. F. Fogelstrand, Kensington, Conn.
5,699.—CEILING HOOK.—O. F. Fogelstrand, Kensington, Conn.
5,700 and 5,701.—SODA FOUNTAINS.—G. F. Meacham, Newton, Mass.
5,702.—DRAWER PULL.—J. Ottner, New Britain, Conn.
5,703.—BOLT CASE.—J. Ottner, New Britain, Conn.
5,704.—BRACKET.—J. Ottner, New Britain, Conn.

TRADE MARKS REGISTERED.

703.—WHISKY.—Adams, Blake & Taylor, Boston, Mass.
704.—WHISKY.—D. C. Brady & Company, Louisville, Ky.
705.—LONG CLOTH.—Coffin & Altemus, Philadelphia, Pa.
706.—CARBON OIL AND BURNERS.—M. B. Dyott, Philadelphia, Pa.
707.—MEDICINE.—J. R. Nichols & Co., Boston, Mass.
708.—BURNING FLUID.—W. H. Reed, Indianapolis, Ind.
709.—SHIRTS, ETC.—L. Sternberger, Philadelphia, Pa.
710.—HEATERS, ETC.—Stuart, Peterson & Co., Philadelphia, Pa.
711.—WHISKY.—T. E. Moore, Shawhan, Ky.

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APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending, for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

20,566.—ADJUSTABLE HANGER.—W. Johnson. May 29, 1872.
20,939.—RAILWAY SWITCH.—G. R. Smith. July 3, 1872.
20,538.—HOUSE BELL.—J. Barton. May 29, 1872.
20,681.—SKIRT HOOP.—R. J. Mann. June 5, 1872.
20,618.—HARVESTER.—T. Berry. June 5, 1872.
20,539.—CUTTING PINS.—J. G. Baker. May 29, 1872.

Inventions Patented in England by Americans

[Compiled from the Commissioners of Patents' Journal.]

From February 23 to February 29, 1872, inclusive.

ALLOYS, ETC.—G. H. Smith (of New York city), London, England.
CAST TIRES, ETC.—N. Washburn, Mass.
CUTTING FILES.—A. Weed, Boston, Mass.
FINISHING NAILS.—J. A. Wills, Vergennes, L. S. Kingsland, Burlington, Vt.
KNITTING MACHINE.—D. Bickford, New York city.
LEVER FOR MOVING RAILWAY CARS.—W. H. Chase (N. Y. city), London, Eng.
PNEUMATIC BRAKE.—G. Westinghouse, Jr. (of Pittsburgh, Pa.), London, Eng.
RAILWAY RAILS.—T. R. Timley, Tarrytown, N. Y.
SAW.—E. M. Boynton, Grand Rapids, Mich.
SEWING MACHINE.—N. A. Baldwin, Milford, Conn.

FOREIGN PATENTS--A HINT TO PATENTEES.

It is generally much better to apply for foreign patents simultaneously with the application in the United States. If this cannot be conveniently done, as little time as possible should be lost after the patent is issued, as the laws in some foreign countries allow patents to any who first makes the application, and in this way many inventors are deprived of valid patents for their own inventions. It should also be borne in mind that a patent is issued in England to the first *introducer*, without regard to the rights of the *real* inventor; therefore, it is important that all applications should be entrusted to responsible agents in this country, who can assure parties that their valuable inventions will not be misappropriated. The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria 36,000,000; Prussia, 40,000,000; and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address

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Practical Hints to Inventors.

MUNN & CO., Publishers of the SCIENTIFIC AMERICAN have devoted the past twenty-five years to the procuring of Letters Patent in this and foreign countries. More than 50,000 inventors have availed themselves of their services in procuring patents, and many millions of dollars have accrued to the patentees whose specifications and claims they have prepared. No discrimination against foreigners; subjects of all countries obtain patents on the same terms as citizens.

How Can I Obtain a Patent?

is the closing inquiry in nearly every letter, describing some invention, which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them: they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, New York, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible, and send by mail. An answer as to the prospect of a patent will be received, usually by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co., 37 Park Row, New York.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention, if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

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A reissue is granted to the original patentee, his heirs, or the assignees of the entire interest, when, by reason of an insufficient or defective specification, the original patent is invalid, provided the error has arisen from inadvertence, accident, or mistake without any fraudulent or deceptive intention.

A patentee may, at his option, have in his reissue a separate patent for each distinct part of the invention comprehended in his original application by paying the required fee in each case, and complying with the other requirements of the law, as in original applications. Address MUNN & Co. 37 Park Row, for full particulars.

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Foreign designers and manufacturers, who send goods to this country, may secure patents here upon their new patterns, and thus prevent others from fabricating or selling the same goods in this market.

A patent for a design may be granted to any person, whether citizen or alien, for any new and original design for a manufacture, bust, statue, alto-relievo, or bas relief; any new and original design for the printing of woolen, silk, cotton, or other fabrics; any new and original impression, ornament, pattern, print, or picture, to be printed, painted, cast, or otherwise placed on or worked into any article of manufacture.

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Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of the former, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension, except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing

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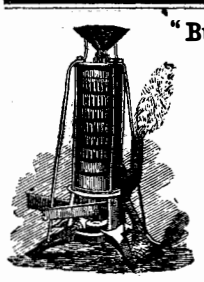

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TWENTY-SIXTH
Annual Statement
—OF THE—
Connecticut Mutual
LIFE INSURANCE CO.,
—OF—
HARTFORD, CONN.

Net Assets, January 1, 1871		$29,747,494 70
Received in 1871:		
For premiums	$1,803,491 91	
" interest and rent	1,924,208 14	
		9,727,700 05
		$39,475,194 75
Disbursements in 1871:		
To POLICY HOLDERS:		
For claims by death and matured endowments	$1,793,266 83	
Surplus returned to policy-holders	4,932,112 80	
Surrendered and lapsed policies	904,862 16	
	$7,630,241 79	
EXPENSES:		
Commissions to agents	$652,488 96	
Salaries of officers, clerks, and all others employed on salary	58,492 92	
Medical examiner's fees	21,544 49	
Printing, stationery, rent, advertising, postage, exchange, etc.	63,016 56	
	790,542 93	
TAXES, including arrears of taxes resisted	308,732 79	
		8,729,517 51
Balance, net assets Dec. 31, 1871		$30,745,677 24

SCHEDULE OF ASSETS, DEC. 31, 1871.

Loans upon real estate (first lien) value $39,512,065		$13,859,554 14
Loans upon stocks and bonds, value $861,497		626,208 28
Premium notes on policies in force		9,285,065 38
Cost of real estate owned by the company		800,692 40
Cost of stocks and bonds owned by the company		4,870,070 55
Cash in bank, at interest		1,202,175 11
Cash in company's office		9,040 08
Balances due from agents, secured		94,876 30
		$30,745,677 24
ADD, Interest due and accrued	$742,864 41	
Rents accrued	3,000 00	
Market value stocks and bonds above cost	399,434 45	
Net premiums in course of collection	60,558 88	
Net deferred quarterly and semi-annual premiums	26,866 68	
	1,232,724 42	
Gross Assets, Dec. 31, 1871		$31,978,401 66

LIABILITIES.

Net 4 per cent re-insurance reserve	$25,609,655 00	
All other liabilities	697,981 92	
	$26,307,636 92	
Surplus		$ 5,670,764 74

Ratio of expenses for 1871	8 12-100 per cent
Ratio of expenses for 1870	8 35-100 per cent
Ratio of expenses for 1869	8 45-100 per cent
Whole number of policies issued by the Co.	116,012
Number of policies in force Jan. 1, 1872	62,458
Amount at risk Jan. 1, 1872	$183,785,236 80

JAMES GOODWIN, Prest.
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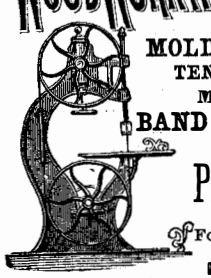

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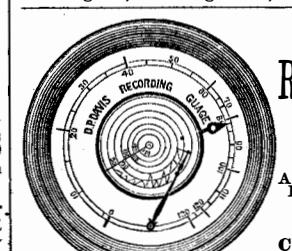

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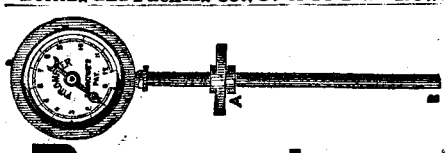

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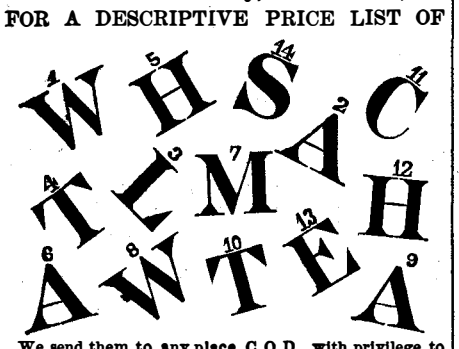

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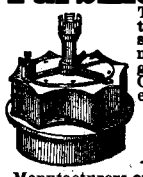

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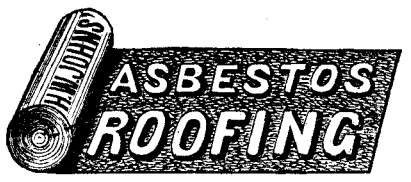

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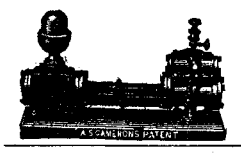

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